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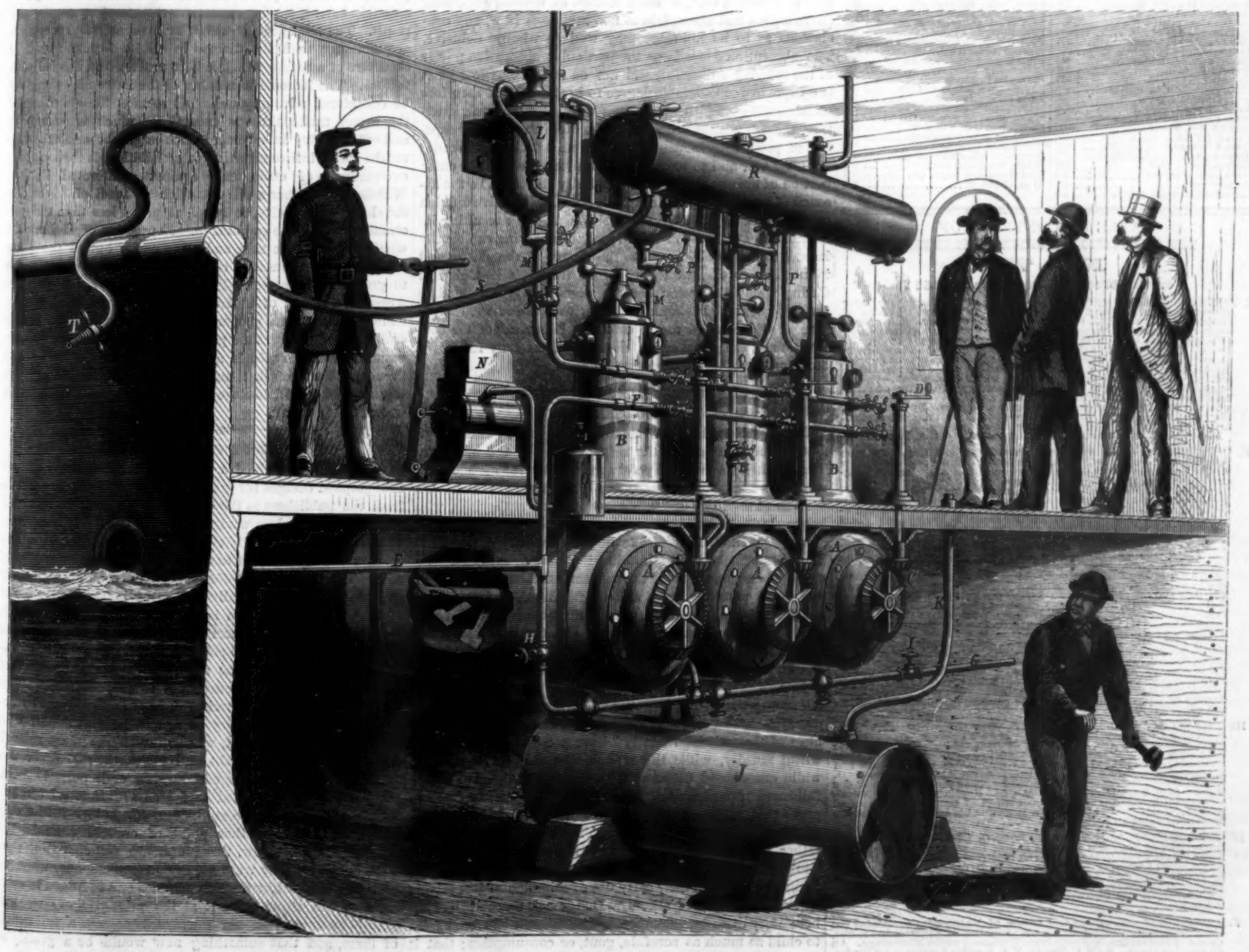
IMPROVED FIRE-EXTINGUISHING APPARATUS FOR VESSELS.

It is not two months since a fine steamer with a cargo of merchandise left Savannah for Nassau. The vessel had but fairly got to sea, when a cask of spirits, which had been improperly stored, broke adrift and leaked; and in some way the fluid caught fire. Although the ship had approved fire pumps, water was found useless against the intensely hot flame which almost instantly communicated itself to the timbers. Of the crew and passengers, who took to the boats, but few were saved. The vessel was entirely consumed. Here was a case where water as a means of extinguishing fire proved wholly inadequate; and we can recall no better illustration of one class of instances where such an invention as that which we are about to describe would have proved perhaps the only efficient means of protection. Again, a year or two ago, an oil ship in a French harbor caught fire. Every effort to put out the flames was futile; and the conflagration, extending to other craft, bid fair to burn all the shipping in the vicinity. A United States man-of-war in the port sent out her boats and towed the burning vessel into the roads, where she finally sank. This is an example of still another class of cases where a fire afloat, unless promptly overcome, is almost certain to result in large loss of property. We have repeatedly in these columns dwelt on the inefficiency of modern appliances in preventing disasters of this description. In a heavily laden vessel at sea, it is even dangerous to pour in water in sufficient quantities to extinguish fire, for the reason that the ship herself may thereby be sunk; and in a harbor there is always the peril of the flames extending to the light inflammable rigging of other ships, even if the difficulty of obtaining a full supply of water under pressure, at any given locality, does not exist. Suggestions have not been wanting for the use of carbonic acid gas as a fire extinguisher on shipboard, based on the successful utilization of the same in chemical engines and other patent devices ashore; but the problem has been how to establish apparatus, in the narrow confines of a ship's hold, which will be perfectly safe, and always ready to afford an instant and full supply of the gas. This is claimed to be solved by the invention here presented; and if we may judge from the successful issue of the trials to which the same has been subjected, the claim must be considered as well as substantiated.

The general principle on which the apparatus is based is the direct use of the dry gaseous carbonic acid in smothering volume, in contradistinction to the ordinary employment of limited quantities of the gas dissolved in water under pressure. The means for carrying out the invention are represented in our large illustration, Fig. 1. The generators, A, are copper cylinders, capable of withstanding some 300 lbs. pressure, lined with tin to resist the acid, and suspended by straps under the deck beams. These vary in number, according to the requirements of the size of the ship, and preferably are about 26 inches in diameter by 9 feet in length, so that each holds about 448 lbs. bicarbonate of soda mixed with water to a paste. Domes, B, extend upward from the generators to a height of 36 inches, and through these the chemicals are admitted. In each generator (as shown by the broken-away portion of one) is a horizontal shaft on which agitating vanes are spirally disposed. When these shafts are rotated, by means of the bevel gearing, C, and cranks, D, a slowly moving current of acid is carried through the soda, and thorough mixing insured. Each dome has a hinged removable cover, Fig. 2. When these covers are closed, they are turned beneath lugs on the dome, and the cap proper is tightly adjusted by lever and screw. Opening outboard is a water supply pipe, E, which communicates with two branch pipes, F and G, respectively above and below the generators. The pipe, F, serves to conduct water to the latter. The pipe, G, may be used as a waste pipe, as it leads outboard on the other side of the vessel; or when the valve, H, is opened, and the valve, I, closed, it conducts water from E, into the cylinders from below, to break up the caked residuum before discharging the same overboard. The acid reservoir, J, is firmly secured on the bottom of the vessel. It is thus situated apart from the other machinery, so that the corrosive action thereon of its contents is avoided; while, if it should leak, no harm would be done, as the acid would simply run into the bilge. The cylinder which has a capacity of 213 gallons is made of one quarter inch lead reinforced by an iron shell, which, while strongly backing and holding the weaker metal, may be easily removed when the inner case needs repairs. The reservoir is charged from the deck above through the pipe, K. The vessels, L, are intermediate and distributing receptacles, to hold the acid in small amounts until needed, and also to apportion the charges to the respective generators. They are of copper, lead-lined; they possess gauges for showing the level of their contents, and are directly connected with the domes, B, by pipes, M. To fill these vessels, a pipe is provided which extends into and near the bottom of the acid reservoir. From this, branch pipes lead to the separate chargers. An air pump, N, the lever of which is shown in the hands of the figure, forces air by a small pipe into the acid cylinder; and the pressure generated drives the acid up through the conduits and into the chargers, L, in quantities as desired. Valves are provided, so that one or all of the chargers may be filled. The alkali generators have like valves in the water pipes, so that water may be admitted to as many as needed.

The carbonic acid gas may itself be used for forcing up the acid by causing the pressure generated in a portion of

[*Continued on page* 388.]



GRANGER'S APPARATUS FOR EXTINGUISHING FIRE ON SHIPBOARD.—Fig. 1.

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BLUE GLASS BLINDNESS.

It is curious to notice in what strange ways a popular mania affects different people. The believers in the blue glass absurdity have hitherto had a monopoly of wild theories on that subject, of which they have invented no lack, to meet the various objections raised, but here is a blue glass skeptic gravely making assertions fully as baseless as the errors which they are aimed to controvert. The skeptic in question is none other than our staid contemporary the *Evening Post*, of this city: which, in its anxiety to warn its readers against an apparent danger inherent in blue glass, perpetrates the following:

"That blue glass has any curative properties remains yet to be proved; but that glass of that color will concentrate the rays of the sun, in a lesser degree, as the common burning glass does, was known before General Pleasonton's book was printed and made so much of by the newspapers. A gentleman of Brooklyn suffering from weakness of sight was recently led by the advice of well meaning friends to use spectacles of blue glass, such as certain opticians are selling just now. The result was that his eyes, already too weak to be used much in ordinary circumstances, were exposed to a terrible glare and heat, which in less than a week entirely destroyed the eyesight of the sufferer. He is now totally blind. This is a fact, and the gentleman would doubtless be glad to have other sufferers from weak eyes know of his case and draw a moral therefrom. Another similar instance has come under our observation, a young lady being in this case the dupe of the blue glass enthusiasts. It is worth bearing in mind that the only property of blue glass that has been proved is its power to concentrate the rays of the sun and produce extraordinary heat."

Neither glass stained blue nor glass of any other color "concentrates the rays of the sun as the common burning glass does." A lens, from the curvature of its surface or surfaces, has the property of causing the luminous rays which traverse it either to converge or to diverge. By a burning glass or double convex lens, parallel rays are conveyed to a focus. If blue glass is made in similar form, it will act similarly; otherwise it will not.

But, as we have repeatedly pointed out, blue glass cuts off a very large proportion of the luminous rays, and the light it transmits is nothing but modified sunlight, or rather sunlight shaded and reduced in intensity: so that, so far from blue glass producing a terrible "glare," it transmits an exceedingly mild light. This property was utilized by photographers long ago in order to relieve the eyes of their sitters; while blue spectacles have been worn by weak-eyed people almost ever since spectacles were contrived.

It is not necessary to discuss the question of whether blue glass becomes hotter through absorption than clear glass, in the absence of any authentic experiments on the subject. It is well settled that, as color teaches us nothing regarding the radiation and absorption of non-luminous heat, any conclusions as to its influence may well be wholly delusive. The absorption depends on the particular absorptive power of the coloring substance, and not on its hue. Clear glass is opaque to a considerable degree to heat rays, and therefore through absorbing them becomes warmed. The only question, then, is whether the coloring matter introduced is capable of producing increased absorption sufficient to render the glass hot, and so to cause it to injure the delicate outer portion of the eye through its proximity thereto. In the absence of any data determining this point, no positive opinion can be formed; but it seems probable that the resulting inflammation of the organ would produce suffering sufficiently intense to indicate its cause to the wearer of the glasses and induce him to discard them before the week had elapsed during which the lesion became permanently extended to the optic nerve. It should be understood, however, that, if blue glass spectacles are injurious, it is because of the constitution of the glass, and it does not necessarily follow in consequence of that glass being blue.

DRUNK OR DISEASED?

The sciences of law and medicine are now in direct conflict on the question of the responsibility of the inebriate. The law holds a drunken person answerable for his acts, and refuses to accept intoxication as a plea in extenuation. On the other hand, one of the highest medical authorities, who has made drunkenness the subject of prolonged and careful study, Dr. D. G. Dodge, late Superintendent of the New York State Inebriate Asylum in Binghamton, says that "inebriety is a condition of the system exhibiting a class of symptoms resulting from a long continued and excessive use of alcoholic stimulants, which brings the subject to a condition he is too weak to overcome; and for which he is not responsible." Society, it would seem, stands in a dilemma from which it is difficult to perceive any present way of escape.

The question is one, however, which demands speedy settlement, for laws are indeed anomalous under which fine-drawn pleas of "emotional insanity" have secured immunity for wilful murder, while the wretch who deals a fatal blow while crazed and diseased with drink is subjected to the full meed of punishment. Much has been written and said to prove that, when a man becomes a drunkard, it is a voluntary proceeding on his part. This is the legal view—or rather, the legal fiction—relative to the subject. There is no doubt that many do become confirmed inebriates through finding pleasure in their early use of stimulants; but this is by no means true of all. Dr. Dodge tells us that, like all hereditary diseases, intemperance is transmitted from parent to child as much as scrofula, gout, or consumption; that it observes all the laws of transmitted disease; that it may even skip a generation, and appear in a succeeding one with all its former activity: that the habit seldom culminates until the subject is thirty years of age, and that the disease is oftenest found among people between the ages of thirty and forty: that certain individuals possess an alcoholic idiosyncrasy, a natural latent desire for stimulants which leads, if indulged, to morbid appetite and a diseased condition of the system, which the patient is powerless to relieve, because the weakness of will that led to the disease obstructs its removal. These are all well demonstrated facts. Dr. Joseph Parrish says that he has known hereditary drunkenness developed after sixty years of sobriety. Dr. Forbes Winslow, before a British Parliamentary Committee, stated that he had observed a list of criminals in which a father was a drunkard, grandfather a drunkard, grandmother an idiot; and in the whole line the family showed drunkards, criminals, and idiots. All the forms of vice were hereditarily transmitted.

The difficulty at once suggests itself of how to distinguish between the man who gets drunk because he cannot help it and then sins, and him who deliberately becomes intoxicated. If we place the drunkard on the same level as the lunatic in regard to irresponsibility for crime, we find ourselves brought face to face with a host of perplexing questions. A man cannot sham lunacy without being reasonably sure of detection; but he can get genuinely drunk, and still have faculties clear enough to execute a purpose of revenge, for example. Neither law nor medicine can positively say how drunk a man must be to be irresponsible. Neither can we unearth every one's genealogy to find out whether his grandfather was an inebriate in order to predicate the hereditary hypothesis. It is evident, therefore, that the drunkard—no matter how he became a victim—must be placed in a different category from the lunatic and the criminal who commits crime automatically. A lunatic is never responsible, society must regard a criminal as always so; but the responsibility of the inebriate depends on a host of circumstances, which may differ in countless instances. It is obviously as much an error to regard every drunkard as an automaton impelled by irresistible impulse as it is to consider him—as we now practically do—a fully reflecting being. The problem is to find the just mean which will cover all cases, or to discover a mode of prevention which will simplify the general conditions.

The preventive remedies which have suggested themselves are two: First, the inebriate asylum; second, the repression of the liquor traffic. The inebriate asylum, though really a curative institution, is in the end the means of preventing the spread of inebriation by hereditary transmission. Intemperance is curable, just as insanity is, in most cases; and, to a certain extent, similar means are used to effect the desired result. The treatment, however, involves skill and thorough acquaintance with the disease in all its forms; and it is therefore of a nature which is best practised in special institutions. The increase in number of the latter may therefore be considered advantageous. As regards the checking of the liquor traffic, there is ground for much argument *pro* and *con*. A step in advance which might be taken, and its results tested before resorting to prohibition, is the stringent enforcement of enactments against adulterated liquors. Whiskey—or rather a vile decoction of fusel oil—is sold in the slums of this city, at retail, at prices less than the government tariff alone amounts to. Repression of adulteration would break up the sale, and place liquor out of the pecuniary reach of thousands of people who are now easily able to gratify their desires. Pure liquors, say authorities, are worse as a source of inebriation than the adulterated ones, owing to the greater proportion of alcobol present. This is doubtless true; but at the present time the immense preponderance of liquor sold is adulterated. Enforce the laws to prevent the sale of that, and maintain a high tariff on pure liquors, and it will become an expensive proceeding to get irresponsibly drunk.

ABOUT GRAVESTONES.

We have just received a volume containing seventy-four lithographed designs for gravestones, accompanied by a note from the publishers to the effect that the book is regarded "as the best modern work on the subject." It is a small volume, and the price is eight dollars, for which sum one might reasonably expect to obtain something new and valuable. The work is no doubt modern, but we fail to discover anything new or especially attractive in the designs. It seems to us—and the idea is one we have long held—that it is about time that a reform in our churchyard architecture was set afoot. We have got into a rut, so to speak, of designs which have been the same from the period "whereof the memory of man runneth not to the contrary." The visitor to the country churchyard, or our magnificent Greenwood, finds them at every turn; and he may depart with the fixed impression that, when gravestone makers emancipated themselves from slabs and tables, the sole decoration of which was the occasional hourglass or impossible cherubic head, they proceeded as far as the funereal urn and broken pillar and there stopped, a few bolder spirits only advancing to the further point of crouching lambs and kneeling angels. Now, these ideas are well enough in their way, or rather they were so, say fifty years ago, when we built our houses like Grecian temples and indulged in other architectural atrocities; but at the present time, we may truthfully assert that our graveyards possess a full supply of them, and that something new would be a gratifying change.

It is needless to state that we opened the book above referred to with these feelings. We need not picture our dismay when nineteen monuments with funereal urns and five with broken pillars met our gaze; and there was the inevitable lamb, and the invariable angel in the usual uncomfortable position which it makes our bones ache to contemplate. There was not a design which seemed to us to offer any striking originality, save one, and that was a most incomprehensible combination of a ewer and basin perched on a slab. What connection existed in the designer's mind between those indispensable toilet utensils and the grave, we should much like to have explained. Some of the gravestones depicted are above average merit; but the stigma of conventionality is upon every one of them. The designers doubtless think they know the public demand, and aim to supply it in the best possible way; and the public taste and judgment perpetuates these trite conceptions, to the exclusion of the new and beautiful designs which an art knowledge, far more advanced than that which originally evolved the former, is capable of producing. We do not refer to lofty and magnificent monuments erected without regard to outlay, because such always are the work of the artist-sculptor and not of the gravestone maker, but to the humbler memorials which mark the thousands of graves in our cities of the dead. There is as abundant opportunity for the application of the principles of true taste and art feeling to these as to the more pretentious piles; and while we are making Nature transform our great cemeteries into beautiful parks and gardens, it would be well if we allowed art to produce forms which would harmonize, and not disagreeably contrast, with Nature's handiwork. Ancient mythology and the tombs and relics of the Old World abound in appropriate emblems which might find more place on the modern gravestones than they now do. What architect or artist will strike out in a new and original line of thought, and give us something better than the upright slab, pillar, or obelisk for marking the graves of the dead?

HELPING INVENTORS.

A co-operative movement, based on the English system first started at Rochdale, has been begun in Indiana and other western States. The organization is on the masonic plan, there being a "Grand Guild" and subordinate "Guilds," the latter of which have for their object apparently the promotion of co-operative enterprises of any legitimate character. Among other schemes, that of an inventors' union has been projected, whereby inventors are assisted in preparing their devices, a workshop is provided, and other encouragement afforded.

We are of course heartily in favor of any plan which tends to develop invention; but the inventors' union scheme is a very bad one, and it has been many times unsuccessfully tried. There never was and never can be a community of interest among inventors, except so far as all are interested, more than the average run of people, in general progress. The very nature of the inventor's work impels him to keep it out of public notice until it is completed, and his right in it secured to him. There are abundant circumstances under which it might be highly disadvantageous to an inventor's interest for his neighbor to gain a knowledge of his invention; and there are not many inventors who would risk making their models in a co-operative workshop, no matter to what pledges of secrecy other occupants of the room had been committed. Besides, this is not the kind of help our inventors want. In many cases of invention, not only is something originated but the implements for its production must also be contrived. It is impossible to foresee what particular means inventors will use to put their ideas in practical form; and it is useless to attempt to fit up a special shop for that purpose. The needs of inventors are, first, suggestions of devices required, and information of what others are doing or have done in the way of origination or improvement: in brief, ideas which will keep their minds in a channel which is likely to end in their conceiving some object on which to exercise their genius. Afterwards, after the patent is secured, and the inventor has perfected his device, then he sometimes needs assistance to aid in its introduction. Now the "Guilds" can furnish either class of help we have indicated, and do good; but we do not believe that they will ever earn much gratitude from inventors by fitting up a shop and requesting people to come in there and invent. They would find that good reading rooms—such as we have frequently advocated, and which have been successfully established in many places in accordance with our suggestions—will attract thinking people; and if an abundance of mechanical books and papers are provided, and discussion on new mechanical and industrial subjects encouraged, inventions will speedily follow. As regards assisting inventors in introducing their devices, there is no lack of opportunity; but the guild's part in securing the aid could hardly extend beyond bringing investors and inventors into communication. It is useless to attempt to organize an association which undertakes to push any or all the inventions of its members. Discrimination will be found necessary; and as a rule, it is about as easy to convince an inventor that his device is not of superior merit as it is to convince a mother that her baby is not handsome.

We are glad to hear of the existence of the guilds, and can commend their motive in endeavoring to help inventors. But we think that, after a little experience, they will agree with us that it is better for them to furnish means for obtaining ideas, and to leave the inventors to work out the projects based thereon after their own fashion.

LIGHTNING RODS.

A correspondent of the *Country Gentleman* writes to the editor of that paper as follows:

"Having read the recent article in your journal relative to lightning rods, I venture to propound the following inquiries: Given a large building, say a church with spire, the spire covered with tin and painted, the church roofed with slate, valleys of copper and conductors of tin, a rod with points soldered to the tin roof, the latter connected by strips of copper soldered to the copper valleys, the tin conductors connected by strips or rods of copper from the bottom with permanent moisture underground—is the building protected against lightning? (1) Would the building be better protected if the above conductors were attached in the building to the gas pipes? (2) Does the paint on one side of the tin materially reduce its power of conduction? (3) Is it not an accepted theory that the closer the rods are attached to a building the better? (4) Do you approve of the method used for protection of the Centennial buildings, as explained in the SCIENTIFIC AMERICAN of about a month since? (5). W. H. G.

To which the editor of the *Country Gentleman* replies:

1. We do not perceive why this would not make a good connection throughout, and afford ample protection. The different connections might be more liable to become detached in the lapse of years than a firm rod, and would need looking to. In case the points above should prove insufficient to carry off silently the fluid from a heavily charged cloud immediately above, and there should be an explosion (a rare occurrence in such a case), there would be more liability to injure the building than if the rod were a foot or two distant from the building. 2. Gas pipes, well connected, would make good conductors, with the same liability as that just mentioned. 3. Paint does not reduce the conducting power. 4. It is better that the rod be a short distance off from the building, for the reason already explained. 5. We do not know the mode adopted on the Centennial buildings, and have not the paper referred to at hand.

REMARKS UPON THE ABOVE ANSWERS.—(1) We coincide substantially with the *Country Gentleman* in respect to the general sufficiency of the above example of protection. The proposed connections above ground are correct; but if there is any deficiency, it is in the underground connections. The terminal metal of the rod, placed underground, in contact with moist earth, should be as extensive in area as possible.

We think it erroneous to suppose that lightning rods are a means of *silently* discharging the electricity of thunder clouds. The latter are generally more than half a mile distant above the earth when the discharge takes place; and while a properly arranged rod, if struck, will conduct the electricity safely to ground, the sudden leap of the lightning through this air space to the rod sets the air into tremendous vibration, producing sounds like the roaring of artillery. Only the atmospheric electricity, close to the surface of the earth, is conducted to the ground silently by rods, buildings, trees, etc.

The object of the rod being to conduct off electricity from the building to earth, the rod should consequently be placed in close contact with the building, so that the electricity may easily reach it; the rod should not be separated a foot or two, as our contemporary suggests; the explosion he refers to is the crashing noise, which the rod can neither cause nor prevent.

(2) The protection of the building would be improved if the conductors were attached, in the building, to the gas pipes. But the attachment of the foot of the rod to the gas pipes, outside of the building, would be more convenient—these connections to be additional to the large metallic terminals in moist earth, before mentioned.

As to inside gas pipes, they are good conductors, and all that is necessary is to bridge over the space between the street pipe and house pipe, occupied by the meter and its lead pipe, with copper wires. The lead pipe is a poor conductor. By using the copper bridge, if the gas pipes in the house are struck, the electricity will pass off into the earth.

(3) We agree with our contemporary.

(4) It is an accepted theory that the closer the rods are attached to the building the better. The reply of our contemporary is incorrect, for the reason explained under (1).

(5) The mode adopted on the Centennial buildings was to connect the metallic roofs with the earth, by means of numerous rods soldered at different points to the roof, and carried directly down into the ground, and there soldered to the extensive system of eight inch underground water pipes. Thus the rods had the closest possible connection with the roof: while the earth terminals of the rods were provided with a very large area of conducting material placed underground—which latter is the essential thing necessary to render any rod a protection; but is the very thing that the majority of people neglect in rodding their buildings.

Fulton's Account of the First Steamboat Trip between New York and Albany.

In the *Suffolk Gazette*, printed at Sag Harbor, on the east end of Long Island, October 12, 1807, is a letter from Robert Fulton to Joel Barlow, giving an account of the first trip of the first steamboat on the Hudson River. It is as follows:

TO JOEL BARLOW, PHILADELPHIA.

NEW YORK, 22d Aug., 1807.

MY DEAR FRIEND: My steamboat voyage to Albany and back has turned out rather more favorable than I had calculated. The distance from New York to Albany is 150 miles; I ran it up in 32 hours and down in 30 hours. The latter is just 5 miles an hour. I had a light breeze against me the whole way going and coming, so that no use was made of my sails; and the voyage has been performed wholly by the power of the steam engine. I overtook many sloops and schooners bearing to windward, and passed them as if they had been at anchor.

The power of propelling boats by steam is now fully proved. The morning I left New York there were not perhaps thirty persons in the city who believed that the boat would ever move one mile an hour or be of the least utility. And while we were putting off from the wharf, which was crowded with spectators, I heard a number of sarcastic remarks; this is the way you know in which ignorant men compliment what they call philosophers and projectors.

Having employed much time and money and zeal in accomplishing this work, it gives me, as it will you, great pleasure to see it so fully answer my expectations. It will give a quick and cheap conveyance to merchandise on the Mississippi, Missouri, and other great rivers which are now laying open their treasures to the enterprise of our countrymen. And although the prospect of personal emolument has been some inducement to me, yet I feel infinitely more pleasure in reflecting with you on the immense advantage that my country will derive from the invention.

However, I will not admit that it is half so important as the Torpedo system of defence and attack; for out of this will grow the liberty of the seas; an object of infinite importance to the welfare of America and every civilized country. But thousands of witnesses have now seen the steamboat in rapid movement, and they believe—but they have not seen a ship of war destroyed by a torpedo, and they do not believe. We cannot expect people in general to have a knowledge of physics, or power of mind sufficient to combine ideas and reason from causes to effects. But in case we have war, and the enemy's ships come into our water, if the government will give me reasonable means of action, I will soon convince the world that we have surer and cheaper modes of defence than they are aware of.

Yours, etc.,

ROBERT FULTON.

Transparent Gold.

In the course of a lecture on gold, delivered before the Franklin Institute, on February 27th last, Mr. A. E. Outerbridge, Jr., of the Assay Department of the Mint in Philadelphia, Pa., gave an account of some experiments he had made, with the view of ascertaining how thin a film of gold was necessary to produce a fine gold color.

The plan adopted was as follows: From a sheet of copper rolled down to a thickness of $\frac{1}{1000}$ of an inch he cut a strip 2½ by 4 inches. This strip, containing 20 square inches of surface, after being carefully cleaned and burnished, was weighed on a delicate assay balance. Sufficient gold to produce a fine gold color was then deposited on it by means of the battery; the strip was then dried without rubbing, and re-weighed, and found to have gained one tenth of a grain, thus showing that one grain of gold can, by this method, be made to cover 200 square inches, as compared to 75 square inches by beating. By calculation, based on the weight of a cubic inch of pure gold, the thickness of the deposited film was ascertained to be $\frac{1}{2000000}$ of an inch, as against $\frac{1}{133333}$ for the beaten film. An examination under the microscope showed the film to be continuous and not deposited in spots, the whole surface presenting the appearance of pure gold. Not being satisfied, however, with this proof, and desiring to examine the film by transmitted light, Mr. Outerbridge has since tried several methods for separating the film from the copper, and the following one has proved entirely successful:

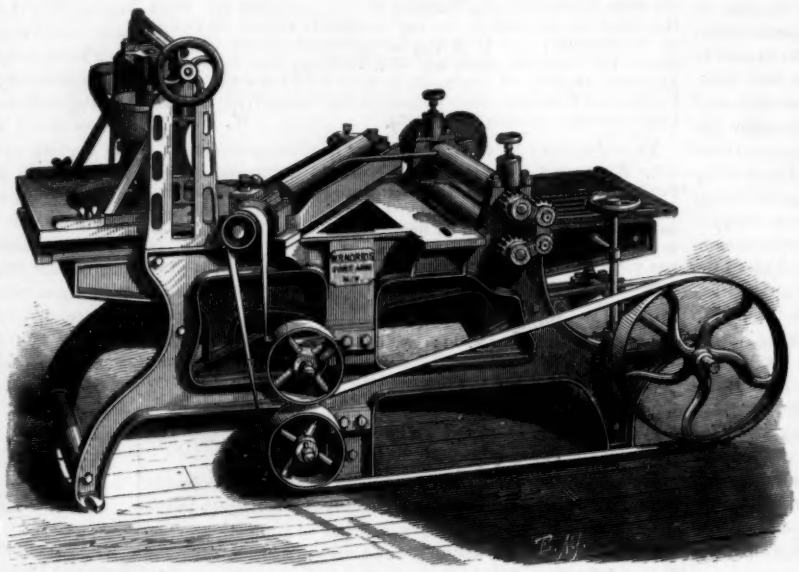
The gold plating was removed from one side of the copper strip, and by immersing small pieces in weak nitric acid for several days, the copper was entirely dissolved, leaving the films of gold intact, floating on the surface of the liquid. Three were collected on strips of glass, to which they adhere on drying, and the image of one of them was projected on the screen by means of the gas microscope. It was observed that it was entirely continuous, of the characteristic bright green color, and very transparent, as was shown by placing a slide of diatoms behind the film. By changing the position of the instrument, and throwing the image of the film on the screen by means of reflected light, its true gold color was seen. Mr. Outerbridge has continued his experiments, and, by the same processes, has succeeded in producing continuous films, which he determined to be only the 1 two million seven hundred and ninety-eight thousandth ($\frac{1}{2798000}$) of an inch in thickness, or ten thousand five hundred and eighty-four (10,584) times thinner than an ordinary sheet of printing paper, or sixty (60) times less than a single undulation of green light. The weight of gold covering 20 square inches is, in this case, thirty-five thousandths ($\frac{1}{28571}$) of a grain: one grain being sufficient to cover nearly 4 square feet of copper. The film is perfectly transparent and continuous, even in thickness, and presents all the characteristics of the one shown before. That a portion of the image appears darker is due to superposed films, the intensity of the green color being proportioned to the thickness through which the light passes.

Riches and Reason.

The experience of the late Mr. John Daly, of this city, who got riches but lost his reason and committed suicide, points a moral for our time. The case of Dr. Ayer, the well known millionaire, who is in an asylum for the insane, furnishes a commentary on the failure which some men are making by their appetite for money. There are scores of similar cases of insanity caused by a too intense application to business. Brains are of more account than bank notes, even in this world, truthfully says the *Christian at Work* and it is never wise to risk one's head to accumulate a property for other people to quarrel over.

IMPROVED DIAGONAL PLANING AND POLISHING MACHINE.

The accompanying engraving represents one form of Norris' diagonal planing and polishing machine, which is a Woodworth planing machine of the raising and lowering bed class, and of improved construction. The cutting cylinder is made to be changed, at will, from its usual position of square across the machine, to a diagonal one of 35°, and *vice versa*. A polishing device is also provided which, when suitably adjusted, polishes the surface of the material after the latter has passed the planing cylinder. Among the advantages claimed is that, when smoother surfaces than can ordinarily be produced by planing machines are required, the cylinder can be instantly swung into the diagonal position, and the polishing device thrown into gear; rough lumber fed in then emerges with the surface planed and polished, ready for paint, oil, or varnish. With the cylinder working diagonally, all kinds of framed articles, such as doors, sashes, blinds, ends of bureaus, commodes, desks, cabinet organs, etc., are claimed to be planed, as easily, perfectly, and cheaply as common lumber, and with the polishing device in operation they are polished perfectly at the same time. The manufacturer states that two men are enabled to do the work of twenty skilled men with hand tools, and at the same time make better surfaces. The machine is adapted for the uses of carpenters' and joiners' shops, sash, blind, and door factories, cabinet-makers' shops, cabinet organ, furniture, railroad, and street car factories, whether large or small, using the cylinder square across for ordinary surfacing, and diagonally for *smooth* planing and where flat frame work is to be smoothed.



NORRIS' PLANING AND POLISHING MACHINE.

Nearly fifty of Mr. Norris' machines are, we are informed, in use in the sash, blind, and door factories of the United States and Canada. The machine from which the annexed engraving was prepared is in use in the largest walnut furniture factory in this city.

Further information may be obtained by addressing W. R. Norris, Fort Ann, N. Y. Arrangements for the manufacture of these machines in Canada are desired.

IMPROVED CALF MUZZLE.

Mr. August Miller, of Salina, Kansas, has patented, January 18, 1876, a muzzle for calves, by which they can be effectively prevented from sucking the cows when in the same inclosure with them, without being hindered from grazing or getting other food. The muzzle may also be used for dogs and other animals with advantage.

In the engraving, A represents a rigid frame, made of a solid or full-top part, of zinc or other material, that is fitted on the nose of the calf or other animal to protect the same against getting chafed or sore. The top plate is fastened thereto by a flexible head strap, *a*, and a lower jaw strap, *b*. A swinging guard plate, B, is hinged to the front edge of the full-top frame, A, and it extends fully across the front of the mouth. The guard plate has at both sides hinged plates or boards, C, with projecting spur-shaped rear and top extensions, *d*, that serve to hurt the cow when the calf attempts to suck, so that it is driven off and prevented from taking hold of the teat. The front and side guard plates close over the mouth on the upward motion of the calf's

head, but do not interfere with the grazing or other feeding when the head is in downward position, as the plates swing away from the nose and admit the free use of the mouth. The side plates, C, are provided at the top spur, *d*, with inwardly projecting catches, *e*, that engage the side flanges, *f*, of the top frame when the calf turns one side up to get the teat into the corner of the mouth. The side plate is thereby locked to the frame and shuts out the teat, securing at the same time the position of the front guard plate, so that the same cannot be swung higher by the jerks of the animal's head when trying to get the teat.

A Simple Test for Carbonic Oxide.

All previous methods for estimating or detecting carbonic oxide by oxidizing it with chromic acid, absorbing it in subchloride of copper, or reducing palladium solutions, are tedious and difficult. Professor H. W. Vogel has turned his favorite weapon, the spectroscope, against this, and again brought down his game. The reagent which he employs to absorb the carbonic oxide is simply blood and water. This mixture is so dilute as to have only a faint red tinge, and, when placed in an absorption cell, 1·8 to $2\frac{8}{10}$ inches thick, shows distinctly the well known absorption bands. In testing the air of a room for carbonic oxide, he takes a bottle that will hold 100 cubic centimeters, fills it with water, and then empties it in the room where the test is to be made. Of course, as the water flows out, the suspected air rushes in to fill the bottle. About 2 cubic centimeters ($\frac{1}{8}$ cubic inch) of the diluted blood is poured in, and the bottle shaken for one minute only. The color of the blood changes, it looks more pink, the absorption bands are a little paler and pressed a little back to the left or end of the spectrum. A skilled spectroscopist would notice this at once; but for the less experienced, Professor Vogel adds 3 or 4 drops of strong sulphide of ammonium. If the blood is free from carbonic acid, the two bands near D and E disappear, and a broad faint band appears between where these were; but if carbonic oxide be present, these bands remain unchanged, when the sulphide of ammonium is added.

To test the delicacy of this reaction, Dr. Vogel took the usual mixture of carbonic acid and oxide, as obtained by the action of sulphuric acid on oxalic acid, and mixed it with 60 volumes of atmospheric air, and by shaking two minutes with 2 cubic centimeters of the blood solution, the reaction was very unmistakable. As little as 0·4 per cent of carbonic oxide in the atmosphere can be detected in this way by taking 500 cubic centimeters (about 1 pint) of the air and shaking with 3 cubic centimeters of dilute blood. The quantity of blood required is so small that Dr. Vogel suggests that the experimenter can draw it from himself, or fresh blood can be kept in the laboratory for a week by the use of salicylic acid. The reaction could be rendered more delicate if the oxygen were removed. Carbonic acid is readily detected in this way in tobacco smoke and in illuminating gas.

New Copying Ink.

The best kinds of copying ink are usually prepared by adding a few per cent of alum to an extract of logwood of 10° B., or to a decoction of the same; and then, to improve its copying power, some sugar and glycerin, or table salt is added. Such inks have a violet tint, are purple when first written with, and gradually darken on the paper. The copies taken from them are at first very pale, and only slowly darken.

Professor Gintl states that a new kind of Parisian copying ink has been recently introduced into Germany, which differs from those previously in use in having, while liquid, a more or less yellowish red color; but on paper it rapidly turns blue, and immediately produces a distinct blue-black copying ink. Moreover, it remains liquid a long time; while ordinarily violet copying ink soon gets thick and has sediment in it; this kind copies easily and perfectly.

Experiments and attempts to make this ink lead to the following result, which indicates the method of its manufacture: A logwood extract of 10° B. has added to it 1 per cent of alum, and then enough lime water to form a permanent precipitate. This mass is then treated with a few drops of a dilute solution of chloride of lime (bleaching powder), just enough being added to impart to it a distinct blue-black color, after which dilute muriatic acid is added drop by drop until a distinctly red colored solution is produced. To this solution is added a little gum, and a half of 1 per cent of glycerin. The preparation thus obtained has all the properties of the Parisian copying ink. It is evident that the small quantity of chloride of calcium, formed by this process, greatly increases the copying power of the ink; while the exceedingly slight excess of free hydrochloric acid causes the ink to remain liquid by holding in solution the lime and alumina lakes of logwood. When the writing dries, the acid gradually escapes or is neutralized by the trace of alkali in the paper, so that the blue-black lake is left. It is evident that any considerable excess of muriatic acid must be avoided, as also the use of too much chloride of lime solution.—*Deutsche Industrie Zeitung.*

Heated Air instead of Oxygen in the Lime Light.

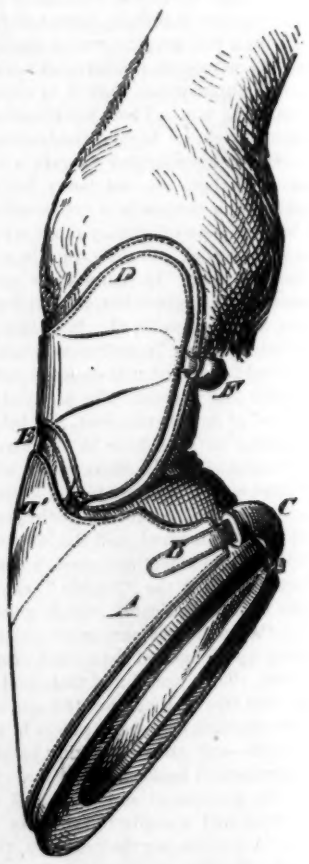
Means of producing artificial light of good actinic quality at a moderate cost, without risk of explosion or other danger, must always interest photographers, and many and various experiments made from time to time have been brought under the attention of our readers. The oxyhydrogen light has, of course, satisfied the condition of efficiency; but besides the cost of oxygen there has been the greater objection of risk in its preparation, storage, and use. Mr. Woodbury has recently been good enough to bring under our attention the result of some experiments, by which he hopes to obtain a light, in all respects efficient for lantern purposes and for enlargement, in which, whilst obtaining the brilliancy and the purity of incandescent lime, he dispenses entirely with oxygen in obtaining it.

Mr. Woodbury does not claim to have invented a new thing, but he has made a valuable application of an existing thing. Some of our readers may be familiar with the Fletcher blowpipe, in which a jet of heated air, inside a gas jet, emerges at the same orifice as the gas, into the flame of which it enters, producing an intensely hot concentrated flame. This constitutes the Fletcher blowpipe. The air pipe is connected with an air bag, sending a stream of air through it, finally entering a spiral tube, which twines round the gasburner, both being heated by a Bunsen burner underneath. The intense jet to which we have referred is made by Mr. Woodbury to play upon a lime cylinder, by which is produced a concentrated flame of very intense brilliancy and pure actinic color, admirably suited alike for the sciopticon or other magic lantern, and for photographic enlarging purposes.—*London Photographic News.*

IMPROVED HORSE BOOT.

Mr. Joseph Fennell, of Cynthiana, Ky., has patented through the Scientific American Patent Agency, March 31, 1876, an improved boot, which is herewith illustrated. It is designed to protect the hoof, pastern joint, and fetlock joint from being cut or injured by the overreaching or interfering of the horse when being driven at high speed, and is so constructed as not to chafe or stiffen the joints or confine or cord the leg. It allows sand to pass out readily.

A is the lower or hoof boot, which is so formed as to cover the hoof, to which it is secured by a strap, B, buckled tightly around the heel of the hoof just above the shoe. Upon the strap, B, is placed a rubber tube, C, four inches, more or less, in length, which prevents the strap, B, from slipping. The forward part, *a'*, of the boot, A, is extended upward to cover and protect the corona of the hoof and the pastern joint, which extension, *a'*, is padded to prevent it from chafing the said joint, D is the upper or speedy-cut boot, the lower edge of which is concaved to correspond with the extension, *a'*, of the hoof boot, A, and is connected with the upper edge of said boot, A, by two or more flexible straps, E, so that the boot may not interfere with the proper play of the joints. The boot, D, is secured in place by a small strap, F, buckled around the fetlock, and which is only designed to keep the boot, E, from falling down. The strap, F, is padded, and buckled loosely, so that it cannot chafe or cord the leg. The boot, E, is padded upon the inner side, and is made flaring both upward and downward, so that it cannot confine the sand, but will allow it to pass out freely.



PURIFICATION OF BISMUTH.—M. E. Smith adds to 16 parts of bismuth, kept in fusion at the lowest possible temperature, 1 part of a mixture of 8 parts of cyanide of potassium and 3 parts flowers of sulphur. After fifteen minutes the metal is allowed to cool.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NEW SERIES—No. XXVIII.

PATTERN MAKING.—BEVEL WHEELS.

"He who can make a good bevel wheel is a good pattern maker." That was once the saying; but the system that divides a trade into specialties is now growing to be the general custom, and it has robbed the expression of half its truth, for there are many good pattern makers who have been engaged all their lives in specialties remote from bevel wheel making. We give the saying, however, merely to show the importance that has always been attached to work of this kind, not undeservedly. A pair of bevel wheel patterns, fresh from the workman's hand, especially if of mahogany and nicely varnished, excite general admiration. It is a job easy enough to do; but you must know the way: that way is what I shall endeavor to elucidate.

Fig. 205.

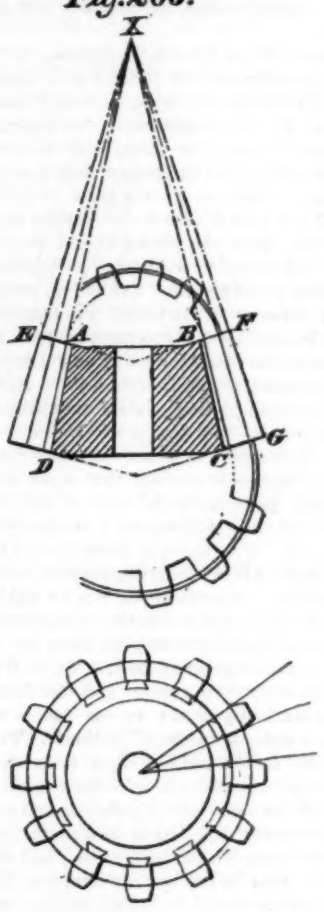
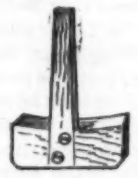


Fig. 205 is a sectional elevation and plan of a bevel pinion; the construction of the body does not differ materially from that of a spur. We may commence building up, if the pinion is of such size to require building, from the small side, A B, for the reason that it is desirable and convenient to turn the part, where the teeth are to be, last, when the building is completed; or if it is a solid piece, we begin by turning off to the line, D C, then reverse on the chuck and turn A B, making a slight recess for the core pivot, set a bevel to the angle, A B C, on the drawing, and turn the circumference to it and at the same time to the required diameter, making it perfectly true and straight for the reception of the teeth. Very little, if any, sandpapering is to be done on this part; it destroys the evenness of the surface. With a fine tracing point, and while the lathe is in motion, mark a line near to D C on the circumference, or, properly speaking, the face. Upon this line the pitching or dividing is made to determine the position of the teeth; divide this line into as many parts as it is desired to have teeth. It often happens in performing this division that, having passed the compasses around the piece, we do not fall exactly into the starting point, but yet are so near that we cannot shift the compasses, even if they are furnished with a slow-motion screw, without making the error greater. The usual way of overcoming this difficulty is to give the compass points a few slight rubs upon the oilstone inside or out, according as we wish either to enlarge or diminish the distance between them.

When a pair of bevel gears are geared together, all the teeth on each wheel incline towards a single point; this point is where the axial lines of the shafts would meet if produced. In order to give this direction to the teeth of a bevel wheel or pinion, we must set them square; but to an article of the shape we have produced, an ordinary square cannot be applied in this case, and the workman calls to his aid one of the simplest problems in practical geometry, namely, to erect a perpendicular to a given line. This is illustrated in Fig. 206, where the whole outline is supposed to represent the turned body of the pinion. A B is the line passing around it, of which we have previously spoken. In it take any point, C; it may be one of the points already made in pitching off. With C as a center, and at any distance convenient, mark D and E; with D and E as centers, and at any suitable distance, mark the arcs which intersect at the point, F. Join F C; it is the perpendicular line required. As it would be too troublesome to go through this operation for

Fig. 206.

Fig. 207.

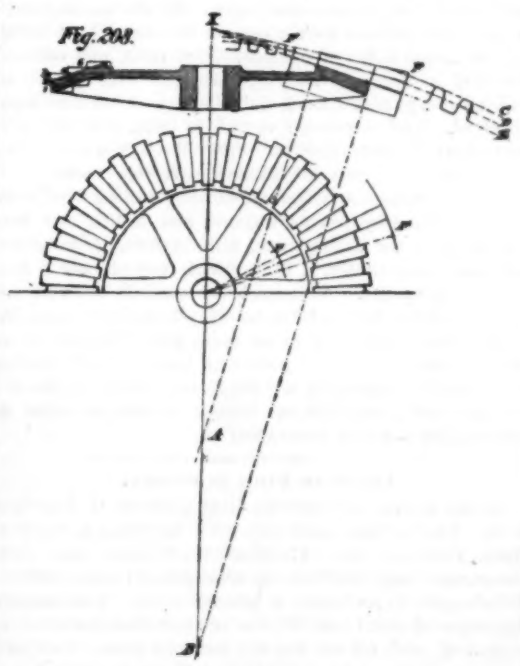


every tooth on the wheel or pinion, a square has to be made, such as shown in Fig. 207; the back is generally a piece of pine gauged to fit the edge of the rim or face; a hard wood blade is screwed to it, so that, when the back is applied to the rim, the blade may be made to coincide with the perpendicular line, F C; all the rest of the perpendiculars required at the points of division are traced by this square. Another method even more simple is to plane a piece of thin wood to lie upon the hand-rest of the lathe, so as at the same time to coincide with the perpendicular drawn by the aid of the compasses; it is then correct for tracing the others. This arrangement is shown in Fig. 209.

If we intend simply to glue and brad the teeth, we proceed to make blocks, a little larger every way than the teeth require to be, hollowing out one side to fit the cone of the body of the pinion. These blocks are glued on to the lines; and when the work is set, it is returned, this time setting the bevel to the angle, E F G. A pitch line must be traced on each side; redivide and draw in the outline of the teeth on the larger side; then, by the methods already described for making perpendiculars, transfer the points of the teeth to the small side; then complete the outline, following out the same principle adopted in tracing the large side: that is to say, taking corresponding centers and distances proportionate to the diminished size of the small side of the cone, as shown in Fig. 205, where the large and small ends of three teeth are set out.

When the subject of spur pinions was under consideration, I deferred making any remarks upon the attachment of teeth by dovetails until bevel gear should be treated on; let us now consider the advantages and disadvantages, if any, of this mode of fixing the teeth. We have long ago mentioned the property which wood has of altering its size according to the dryness or humidity of the atmosphere, which

Fig. 208.

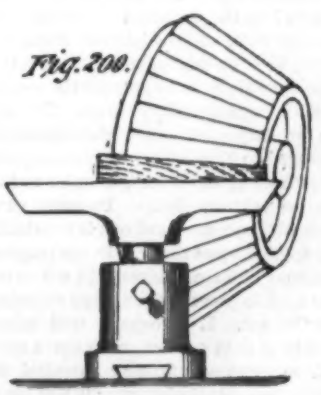


alteration, though considerable across the grain, is very slight in the direction of its length. Hence, when teeth are glued to a body, the grain of which crosses that of the teeth, there will be a movement between the two when the pattern is subjected to a change in dampness or dryness; the dovetail allows freedom for any movement from these causes, retaining the tooth in its position under all circumstances. Should the mould happen to break down in the act of withdrawing the pattern, it may be restored to a considerable extent by knocking out a few teeth, placing them in the damaged impressions left by the pattern, and bedding up the sand around them. It sometimes happens that the teeth of a bevel wheel or pinion will be too much undercut to leave the mould without damaging it; this method will admit of the teeth being withdrawn in detail, after which the pattern can be lifted without difficulty. To counterbalance these advantages must be mentioned the extra cost inseparable from this method of fixing the teeth. This, however, is really a small matter when dealing with pinions; and therefore bevel pinions usually have their teeth attached by dovetails, excepting those of small size. If it is decided to use dovetails, we proceed as follows: The body of the pinion has been turned and divided, and the perpendiculars all finely drawn in. Cut out of thin wood a piece of the size which the dovetails are intended to be, which is such that a small margin of tooth may be left on each side; set the piece on the rim, at a distance from a perpendicular equal to the margin allowed; set it by the square shown in Fig. 207, as the dovetail must have such a taper that its sides may both tend towards the point, X, before alluded to, namely, the intersection of the axes of the shafts. This will be the case if, when one side of the dovetail template has been set square, the other is square also. By this template, lines for all the dovetails are scribed on the face; the depth is laid off on the drawing by lines tending toward X; and from this the depth of each end of the recess may be gauged on the pattern. No curvature is given to the bottom of this; it is pared out flat with the chisel; the dovetails are now fitted, and left projecting above the face; they are driven moderately tight; the projecting parts are then turned off level with the rim.

We have now to go through the same process as before described for making and attaching teeth. When the glue is well set, each should be knocked out, numbered, and the dovetail bradded. Fig. 208 is a section and half plan of a bevel wheel; in the latter the shape of the teeth is not shown, but merely their thickness at the pitch line; in the sectional view, a few teeth are laid out in profile upon arcs struck from the centers, A and B, which are the points of intersection of perpendiculars from the ends of the teeth (at the pitch line) and the center line. In the section on one side is shown a series of rectangles numbered from 1 to 5; these represent the segments of which the rim is composed. It is true that they might be made more nearly to approximate to the shape of the rim by sawing them to a bevel, but a machine suitable for this is not in every shop; and when it is considered that the segments themselves are usually not more than ¾ inch in thickness, it will be seen that the additional complication counterbalances the saving in lumber and time in turning. If, however, the wheel is very large, or where thick segments are employed, we may advantageously saw the segments to a bevel. The method described for turning the bevel pinion is exactly suitable for the wheel; the arms will be checked together, but need not be built into the rim, unless we desire an exceptionally strong pattern; the obliquity of the rim enables us to get a good purchase, by means of screws through the end of each arm into it. Care must be taken to have the ends of the arms each to bear properly on the rim; otherwise the rim will be thrown out of true in screwing.

It will be remembered that, in treating upon the spur wheel, we had, in forming the box for shaping the teeth, simply to draw out on each end the natural size of the tooth, that is, if we except a slight diminution towards one end for draught; but the conical form of a bevel wheel gives a little extra trouble. In Fig. 208 the tooth proper is of the length of the face of the wheel, as seen in section. Now all lines

Fig. 209.



bounding the teeth must converge to the point, X; so if we take F F to represent the length of the box, we must strike out upon the large end an enlarged, and upon the small end a diminished, tooth; then by planing to these lines we shall have formed such a box that any piece shaped in the gap formed in it will be of the proper size and shape for a tooth. It would confuse our engraving too much were we to attempt to show the enlarged and diminished tooth on the ends of the box; but the principle is easily understood, as we have but to follow out whatever method has been adopted on the drawing for producing the tooth curves. It will be necessary to recur to this subject again when treating specially upon the methods of tracing out the curves suitable for teeth.

SINCE the first of the year New York has exported over 70,000,000 gallons of petroleum against 25,000,000 by all other ports. Last year the city had only about half the trade.

[*Continued from first page.*]

the apparatus to act so as to drive the liquid up into the other parts. This is done by a simple adjustment of valves and connections which need not here be explained. Steam may also be conducted to the acid reservoir to serve the same purpose. A water trap, O, is provided in the air pump pipe, which prevents the acid fumes from injuriously affecting the working parts of the pump. The pipes, P, connecting the domes with the chargers, serve to equalize the pressure between the two, and to permit the free passage of the acid down to the generator, when the chemicals are to be mixed, by preventing a vacuum above the acid. Each dome, by means of a horizontal distributing pipe, Q, with suitable vertical branches, communicates with the gas holder or purifier, R, into which the generated gas is thus conducted. The purifier is a cylindrical vessel, which is imperforate at the points where the entering gas strikes it in issuing from the branch pipes; and between these pipes it is perforated to admit the passage of the gas. The object of this partition is to eliminate the solid and liquid particles which are mechanically carried up on the form of spray, by causing them to impinge against the imperforate portion of the diaphragms. The gas then passes to the hose, S.

In order to remove the collected impurities from the purifier, a pipe, with suitable valve, leads from the bottom thereof to the discharge pipe, G. In this way, water may be led in from the main supply, E, and also discharged through the same pipe. The latter also serves as a drain for any of the liquid contents of the generator which might surge up into

Fig 2

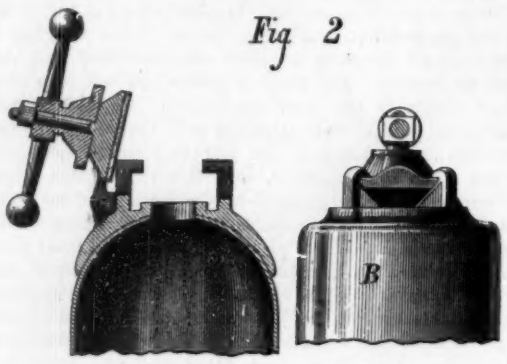
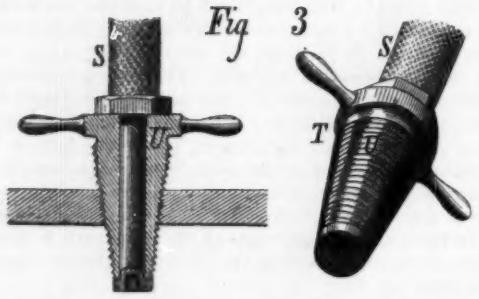


Fig 3



GRANGER'S APPARATUS FOR EXTINGUISHING FIRE ON SHIPBOARD.—Figs. 2 and 3.

the holder; and thus it operates as an equalizer to restore the said liquid to the generators. In order to introduce the gas into the burning vessel, without causing it to entrain air with it, the nozzle, T, Fig, 3, has a tapered screw-threaded swiveling sleeve, U, which is provided with handles, and which may be screwed into a hole of any size bored in the deck. An attendant at the nozzle is thus dispensed with, and the latter is firmly held airtight. An extra pipe, V, is connected to the distributing pipe, and leads into the open air so as to prevent the escape of the gas into the room through the safety valves. There is a separate safety valve on each dome, and also one on the purifier, which is arranged to blow off into the atmosphere at a lower pressure than those on the domes, in order to insure that no gas shall escape between decks. Pressure gauges are also arranged on each generator, and one is provided to indicate the pressure applied upon the acid in the reservoir.

The apparatus, we learn, is already in use on the Protector, a vessel now used to prevent fire among shipping in the harbor of New Orleans. It is equally well adapted for use aboard the ship it is to protect, or upon a small vessel, as above noted, to serve as a floating chemical fire engine in ports. Within two months last year it was the means of extinguishing fire on three cotton-loaded vessels in the above-named harbor. These ships carried respectively 1,400, 960, and 3,200 bales of cotton, and were valued with their cargoes at an aggregate sum of $375,000. We are informed that, with the exception of the bales of cotton which had actually been on fire, in two of the vessels the cotton, after the flames had been subdued, was discharged "in as good order and condition as it would have been at port of destination had there been no disaster." In the third vessel, water was employed by the firemen; but the fire was subdued by the gas. In one instance the flames, which were rising twenty-five feet above the hatches, were brought under control in twelve minutes after the gas had been admitted to the ship. The importance of this invention in such cases as the above is especially great; as cotton, when soaked with water, becomes much deteriorated in value. The United States Board of Inspectors examined the vessels saved. This body, in an official report, recommends the adoption of the apparatus aboard all steam vessels. We need not point out the advantages of the invention to passenger-carrying ships. Even on a man-of-war, where rigid discipline prevails and where fire is provided against by an elaborate system of drill, the outbreak of a fire at sea is apt to produce a panic, as was recently the case aboard the Egyptian cruiser Latif in the Red Sea. On an ordinary ocean steamer, crowded with people, the terrible confusion can be easily imagined. Amid such a state of affairs, it is difficult to collect enough cool-headed people to aid in managing the usual appliances; and every moment of delay in getting the flames under only intensifies the general fear. In such cases the apparatus which we have described, which silently and quickly smothers the conflagration, might well prove invaluable.

Patented through the Scientific American Patent Agency, January 2, 1877. For further information, address the inventor, Mr. A. M. Granger, Exposition Building, New Orleans, La.

Preserving Metals.

For preserving metal and other substances from decay and fouling, Mr. Charles Weightman Harrison, of South Kensington, London, Eng., proposes to dissolve the crystalline hydrocarbon known as ozokerit in any of its solvents, such as benzole, petroleum, oil of turpentine, or resin oil, and he then mixes the solution in any desired proportion with other suitable bodies according to the purpose for which it is required. He mentions that his experiments have been made with ozokerit as a type of the mineral hydrocarbons, which are built up of molecules containing not less than 20 atoms of carbon, such minerals being capable of resisting the action of all acids at ordinary temperatures, and suffering no deterioration from atmospheric influences. On this account he has found them valuable for mixing with gums, resins, and colors applicable to a great variety of purposes for preserving, as they impart thereto a high degree of permanence. He explains that a simple and ready mode of preserving bright metals from rust is to rub them over occasionally with a wax formed by melting together equal parts, or nearly so, of ozokerit and beeswax. It is easily applied in a thin coat by rubbing the compound on the metal with a cloth. In applying this compound wax to iron, he sometimes adds finely powdered plumbago to give it the color of the metal. Another compound or solution for preserving metals he forms by dissolving in a sand bath (say) 4 ozs. ozokerit and 4 ozs. marine glue in 2 lbs. benzole, and then adds 4 lbs. linseed oil and ¼ lb. essence of turpentine. The mixture is kept gently boiling in the bath for an hour or so, after which it is ready for use, and may be applied to the metal by a soft brush, as in ordinary painting. In some cases he impregnates the surface of the metal deeply by forcing the compound of ozokerit into the pores by exhaustion or pressure, or the two combined. A convenient apparatus, which he uses for this purpose, consists of a metal cylinder, such as a wrought iron boiler of a suitable size and strength, equal (say) to about 200 lbs. to the square inch, fitted by connections with exhaust and pressure pumps in a manner which is well known. This cylinder is provided with an airtight door and a safety valve. When the metal articles have been placed in the cylinder, the air is exhausted to about 27 inches of mercury, and the hydrocarbon fluid is then admitted through a connecting pipe until the articles to be impregnated are covered. The pressure is then put on, and the fluid forced into the exhausted pores. He also claims painting or coating metals with a compound formed by melting together about 5 lbs. of ozekerit, 5 lbs. resin, and stirring the fluid in 2 gallons rectified spirit (65° over proof), in which 2 lbs. gum sandarach and 2 lbs. garnet lac have been dissolved. Add turpentine varnish to them, and boil at a gentle heat for an hour or so. Filter through a fine cloth, and preserve for use. He forms a protecting varnish for suspended or open air telegraph wires by coating them with a fluid, formed by mixing together and heating at a low boiling point for a short time, ¼ lb. ozokerit, ¼ lb. gutta percha or india rubber, 1 lb. rectified resin oil, and 2 lbs. linseed oil varnish. As varnish for outdoor ironwork he proposes to dissolve, in 2 lbs. tar oil, ½ lb. ozokerit and ½ lb. resin, mixed while hot in an open pot. The invention also includes a process of poisoning barnacles with strong tonic bitters—Angostura and the like—or weak strychnine; but these not being of direct interest to manufacturers or miners, they need not be referred to.

American Fruit in Europe.

Europe is now taking a surprising quantity of American fruit. The purchases have amounted, according to the New York *Tribune*, to over $2,500,000 worth since June, 1876, compared with $600,000 in the same period the year before. Dried apples figure largely in this movement. This country has exported over 12,000,000 lbs. of them since last June, as compared with 522,000 lbs. the previous year. This new addition to the trade of the United States is due to invention, which has occupied itself of late with improved methods for drying and preserving for transporting fruit. The greatest progress has been made in the way of dryers. Within a year some notable inventions in this line have been perfected which are a great acquisition to the resources of the country. The fruit dryer bids fair hereafter to be as much of a necessity to every farming community as the cider mill and the cheese factory.

ACCORDING to the Philadelphia *Trade Journal*, Mr. Peabody, the inventor of the Peabody rifle, receives about $300 a day in royalty.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

In my letter published in No. 22, I mentioned that S. D. Locke had applied to Secretary Schurz for an order directing the Commissioner of Patents to re-hear a case decided against the applicant by Assistant Commissioner Doolittle, which application the Secretary denied. Mr. Locke has since applied to Judge Humphreys of the District Supreme Court for a mandamus directing the Commissioner of Patents to re-hear the case. The hearing was set for May 22, but was postponed until a later day; and on the second day set, the Judge again postponed the case until the fall term.

Under a recent examination of third assistant examiners, in which seventeen competed, Messrs. C. J. Hedrick, F. S. Williams, and R. J. Fisher were appointed second assistant examiners. To fill the vacancies thus made in the ranks of the third assistants, another examination has just been held, in which sixty-five competitors took part, the result of which has not yet been announced, but probably will be before this is published.

The managers of the French Exposition of 1878 have informed our government that, if the United States is to take part in the Exhibition, it will be necessary that immediate steps be taken for representation in the American section. The Secretary of State, by direction of the President, has now under consideration the proper measures to be recommended to the Cabinet to form a basis of a plan of representation of the United States Government and people at the Exposition. Both the President and Secretary express their regret that no action was taken by Congress at the time the notification of the proposed Exhibition, submitted to the Secretary of State by M. Bartholdi, was transmitted to that body. The letter of the late Secretary of State transmitting the notification was accompanied by no recommendation of a plan of representation, on account, it is said, of the dissatisfaction entertained by the late Administration with the action of some of the French Commissioners during our own exhibition. President Hayes and Secretary Evarts, on the contrary, are extremely anxious that some representation should be had, particularly in view of the fact that the French Commissioner Sommerard's conduct was satisfactorily explained. It is thought probable that the best plan will be to appoint a Provisional Commission, with the understanding that the Commission will not be paid unless Congress, when it meets, makes suitable appropriations, and that by this means arrangements may be made for the shipment of articles by American exhibitors. There is no constitutional impediment to this course, and the Secretary thinks there will be no doubt about Congress making the necessary appropriation when it meets in October. The minimum amount wanted for this purpose is said to be about $300,000. Several prominent gentlemen associated in the administrative branch of the Centennial Exhibition and now connected with the Permanent Exhibition, in a recent informal interview with Secretary Evarts, said, as they had the machinery for such work now in efficient organization, they would be happy to co-operate in any way that he might feel disposed to utilize their services. Another plan suggested by a number of prominent American manufacturers of machinery is that some person now in Paris connected with the State Department may be temporarily detailed to take charge of such shipments as may be made until Congress can meet and make the necessary appropriation.

Our Consul at Berlin has submitted to the Secretary of State a prospectus of the Leather Exposition, which is to be held in that city from the 8th to the 24th of September, and recommends that the American manufacturers of that necessary article send exhibits of their wares, which he thinks will turn out very beneficial to the leather trade.

From the Spanish Minister, Secretary Evarts has received a notification that an International Exhibition of Fine Arts will take place in Madrid in January of next year, under the auspices of his government.

Our Consul at Odessa, in a late report to the State Department, has the following: "Agricultural implements might be sent in great quantities to this country if our manufacturers would make an effort in that direction and adapt their implements for the use of the peasantry here. The principal thing to be done is to make them exceedingly firm and strong. American reapers and mowers are now the favorites above all others, and have a large sale. In other machinery the English manufacturers have the field, and I have seen no article of their manufacture that excels the American, unless expensiveness be deemed an excellence. I am persuaded that there is a fine field here for the American threshing machines. During the year an American firm has supplied a railroad here with fifty-five locomotive engines. They were remarkable in strength, power, and workmanship; and I am told that they draw a train easily through heavy snows that, with the engines formerly in use, would have been impassable."

Some three or four years ago, Congress appropriated $100,000 to be expended in experimenting on steam boiler explosions, to discover if possible the cause of some of the mystery that is believed by many to be connected with these accidents, which mystery, however, is generally believed by the best informed engineers to consist in low water. During the then ensuing season, a Commission, of which the Supervising Inspector of Steam Vessels was the chairman, made a series of experiments at Sandy Hook, and about one half of

the appropriation was spent without results of any value worth mentioning. The next season the Secretary of the Treasury placed a gentleman of scientific attainments at the head of the Commission, but with no more satisfactory results. It has now been determined to change the location of the experiments to Pittsburgh, but only about $8,000 of the appropriation remains unexpended, and it is feared that little or nothing will be gained by the expenditure of the $100,000, although great expectations were formed by many of the amount of knowledge that would be obtained from the expenditure of so large a sum.

There are encouraging indications that the spawn of the Californian salmon, deposited at or near the head waters of the Atlantic coast rivers by the United States Fish Commission, has produced large numbers of the young fish. Reports state that young salmon nine inches in length have recently been caught at the mouth of the Connecticut river. They were probably making their way to the ocean, as the young fish are said to remain in fresh water some twelve or eighteen months before going seaward, returning in two or three years weighing from ten to fifteen pounds each. A Richmond paper reports that salmon of the same size as those found in the Connecticut were caught in Hampton Roads going to the ocean, and thinks they were, no doubt, some of the young ones deposited in the James river by the Fish Commission in the winter of 1875–6.

The Director of the Mint estimates that the coinage at San Francisco for the present fiscal year will reach $45,000,000, including $13,000,000 of silver coins.

From a statement furnished by Dr. Young, Chief of Bureau of Statistics, it appears that the aggregate imports and exports for April were: Total exports, $44,515,439; total imports, $42,662,696; for the past ten months of the current fiscal year the exports of merchandise were valued at $514,799,053, the imports for the same time being only $357,584,817, showing a balance in favor of over $157,000,000.

Mr. H. C. Fisher, the general manager of the English postal telegraph, and Mr. W. H. Preece, the engineer, are here for the purpose of making an examination of the working of the American telegraph systems, particularly the use of the sound system, which has not yet been introduced in London, and will visit the principal cities and examine all the operations connected with transmitting and receiving messages.

The Postmaster-General is constantly in receipt of letters from parties who claim to have discovered an indelible ink for cancelling postage stamps. Impressed with the value of such an ink, which would effectually prevent the use of washed stamps, the department made arrangements with experts to test all inks presented, and public notice was given that any ink that was claimed to be indelible would be so tested, and, if the result proved satisfactory, the ink would be adopted. The result was that a large number of samples of ink were presented, and for nearly two years the department experts were engaged in testing these so-called indelible inks; but these tests proved the inks to be so far from indelible that they were discontinued by order of the Postmaster-General; and as there are now no longer any tests made, it is useless for inventors to forward any more samples.

Washington, D. C. OCCASIONAL.

"Knowledge is Power."

Every year an oration is delivered before the Hunterian Society of London, in eulogy of John Hunter, the celebrated physician, from whom the society takes its name. The address of Dr. W. Moxon for the present year is remarkably vigorous. The following is an extract:

"The great fallacy of the age is the vulgar fallacy that knowledge is power. But not all knowledge is power. Only the knowledge you have faith and aim to use is power; and the instinct of each mind is, I believe, a far better judge of how much knowledge it has faith and aim to use than we commonly suppose. Knowledge is not power. Any fourth year's student knows much that Hunter did not, and could not, know. But where is the power of Hunter? Power arises by training in the use of knowledge. Consider the difference between training and teaching. The teacher carries over the things he knows, and fixes them in the learner's memory; the trainer takes what is in the memory, and converts it into an organ for the pupil's own use. The store of memory of things taught is totally distinct and separate from the trained mechanism for use of knowledge. And these two different things—the store and the mechanism—are in separate places in the brain. It is only of late years we can be sure of this. We have it proved obviously in the case of language in what is called aphasia. In aphasia, a person paralyzed on the right side of his body has lost the power of using language, and yet understands all you say. Obviously, then, the understanding of speech is in one place, and the power of framing language is in another place, in the brain. The same is true throughout all human acquirements. The power of knowing is the fruit of knowing, and the power of acting is the fruit of acting. There is knowledge stored in one place, and the power of using it stored in another place. Teaching is the storing of knowledge; it may be done quickly. Training is the creation of an organ for use of knowledge; it needs much time; it is a slow process. The trainer has to convert the pupil's knowledge into motive, his desire into patience, his will into skill. Every good trainer aims to raise up in the pupil's mind a self-training faculty, which shall itself continue to train more and more knowledge into motive. By such training knowledge becomes power. But knowledge, as given by the mere teacher into the memory, is not power; it is so much weight, which by training may become the instrument of power. Now, the self-training spirit is natural to some men—to all great men. On the other hand, the self-training spirit is almost absent in some men. These are the fools, and they trouble every one as to what is to be done with them. But the vast majority of men have some self-training faculty; and the proper aim of education is to support this, which I may call the vital spark of character, by help from the training faculties of others."

Birds' Nests.

"The best way to find nests is to watch a bird while building; in that way, moreover, you are sure to see them in their best condition, and to know when the eggs are fresh. It requires patience; but you see the workers return again and again to the same spot, and a little closer inspection usually completes your knowledge, though you may sometimes be deceived or nonplussed by the caution and cunning of the architects. You will facilitate your work by scattering cotton wool, horsehairs, straws, string, worsted, and cloth where they will attract the attention of the birds about you. Put them on your lawn or on the piazza vines, and watch them. A robin comes to carry off the string, and, having used up what you have provided, and liking the material, attacks a long piece wound round a stake, and supporting a gladiolus. By persistent effort he frees a part of it; but the harder that he pulls the rest, the tighter he ties the knot around the stake, and the string is becoming entangled with his legs; he fights twenty minutes and then gives it up. Sparrows pick up hairs and straws from the lawn, and warblers come to the vines for cotton wool, passing fearlessly within three feet of your chair; then they come back to break off little twigs and to peel off shreds of dry bark from the honeysuckle. A pair of golden robins, the male with black and orange, the female with yellow and duller black, come for string, worsted, and thread; but beware of them, for they are thieves. Leave your knitting under the tree there for five minutes, and it is gone; you will find it a week later, a part irrevocably woven into the hanging nest, and a part dangling with the needle in it. The weaving is so cleverly done that you wonder whether the orioles haven't used your needles. Not at all, madam; I defy you to produce with your implements such a piece of work as these birds have produced with their bills. Successful experiments have been made by supplying the orioles, in the tree where they are occupied, with bright silks and worsteds, which they employ altogether, if liberally provided, so that a very gay and party-colored nest may swing in your orchard where you can see it from the house. Wilson says that an old lady, to whom he showed an oriole's nest in which a piece of dry grass, thirteen inches long, was passed through thirty-four times, asked him, half in earnest, if the birds couldn't be taught to darn stockings."—*H. D. Minot, in Harper's Monthly for June.*

Waste in Machine Shops.

A workshop, however small, however few the number of hands, is never too small to have a system; want of system is the cause of great waste of time and material, besides constant worry and discontent.

Step inside this building of fair dimensions, whose front is covered with big lettered signs, showing that it is devoted to the production of all kinds of machinery.

What do we find? The floor covered with litter, heaps of cuttings under every lathe or machine, under every bench; on the floor new and old material of all kinds have been thrown in almost inextricable confusion; the machinery is encrusted with oil and dirt, except just those parts that meet the hand in working; and the speed cones and pulleys are polished by the running belts, showing what might be and is not.

The cutting tools, the bolts and plates, and other gear used in these machines, lie around their bases; a new stratum seems to be fast closing over some of them. Overhead is heard the harsh grating of some loose pulley; the belts have been thrown off others by some sensitive workman, who cannot bear the unpleasant noise in such cases; the belts dangle from the shafts, the running shaft keeping a stretch on them and wearing them all the time. About thirty men are employed in these works, yet there is no one whose special duty it is to look after the tools, to replace or repair them when lost or broken.

A man has to drill a ¾ inch hole in a piece of plate; the time actually required would be about five or ten minutes if good order were kept in this case. The man commences by making a tour of the shop, for there are some drills lying around this machine, and some around that, and there is no *one place* where every drill not in use is sure to be found. His search is not crowned with immediate success; a ¾ clearing drill (¼¾) is the nearest he can procure; he has set his callipers and taken the size of it; he proceeds to grind it to ¾; having reduced it to the size, he finds it will not clear itself so high as he wishes; however, at last, by more grinding, he is satisfied with it, and is ready to commence—time lost, twenty minutes. He is hardly through drilling, when up comes a man looking for the ¾ clearing drill he was using twenty-five minutes ago; he, finding it has been altered, takes it to the smith, and waits to have it flattened out, which, with the re-grinding, makes a further loss of twenty minutes—total loss, forty minutes on the drilling of a ¾ hole, for which the boss could scarcely charge more than ten cents.

Another has a brass to plane; no tool for brass seems to be visible; he has probably trodden it down too deep in the thick red dust of the flooring to be distinguishable. However, he soon grinds off the tip of a tool for cutting wrought iron; that is easy enough; but when that tool is wanted again to work in the material it was made for, a $\frac{1}{16}$ of an inch must be ground off its facets to restore the original angle—waste of time and steel.

If a workman should happen to drop a small pin, washer, or key, he makes another, because among the *débris* around he knows it is as much lost as though when it fell the earth had gaped to receive it.

Here is a man who has been half an hour filing out the hammer marks he has made in fitting two finished pieces together; another, the same time truing up an arbor damaged by blows on its center with a steel hammer. There was a copper hammer once, but it laid around and now no one knows where it is. A few of the old hands have lock-up boxes, chock full of all kinds of tools and contrivances, and are laughing in their sleeves at the frantic efforts others are making to produce a good job without those proper instruments, kept so securely under lock and key.

The grindstone—that much abused necessity of the workshop—is all out of true, has no water can, and sometimes not even a rest; it is nobody's special duty to keep the grindstone in order, and hence *nobody* does so, while everybody grumbles at its dilapidated condition. As to its speed, the pulley now driving it was put on when the stone was of large diameter, and there it has remained ever since, so that the velocity of the stone is about half what it should be; the slower the speed, the worse condition the stone can get into without wrenching the tool from the hands when grinding with the stone running towards you; hence the speed of the stone is admirably suited to its condition, and both are excellent levers to hoist the proprietor into bankruptcy, which under the above circumstances would just serve him right.—*J. R., in the Polytechnic Review.*

Employers and Working Men.

Difficulties between employers and working men would be less frequent, says the *American Manufacturer*, were their intercourse more conciliatory, and were each to realize that seeming inequalities are but surface appearances; and that the best interests of the one can only be secured in the protection and welfare of the other. Governed by such dispositions and opinions, irreconcilable differences could scarcely arise, because each would take a fair view of the rights and obligations of the other, and willingly make the concessions required by justice and kindness. A reasonable amount of information, derived from observation and reading, is a pre-requisite qualification, and is always found wanting, on one side or the other, where jars and contentions disturb the harmony essential to these relations. Admitting this qualification to be possessed by employers, a further duty devolves upon them, of insisting that their workmen shall possess it also. Men utterly illiterate, who can neither read nor write, cannot possess the self-respect and ambition needed to form skilled mechanics, neither can they be sufficiently enlightened to comprehend their rights and duties, to know when they are well treated, or to understand the fluctuations in business which justify the rise and fall of wages. It is therefore a duty of employers to employ none but persons sober, moral, diligent, and accustomed to reflect—men with whom they can sit down and reason—who can understand just conclusions, and feel the overruling propriety of abiding by them. Where large establishments are organized on these principles, the business moves on with contentment on both sides—each respects the rights of the other—misunderstandings are quietly settled without strikes, and peace and mutual goodwill reign as in well regulated families. Where the instrumentalities of labor are organized, with intelligence and integrity of employers, and with workmen suitably cultivated for respectable American citizenship, the most desirable consequences may be reasonably hoped for: 1. Superior safety of capital in enlightened hands. 2. Economy of time and labor when conscientiously employed. 3. Economy in the use of stock and materials manipulated by instructed men of good principles. 4. For the same reason, the best results may be looked for as to quality and quantity of products. 5. Interests of customers and consumers are better subserved with fabrics made upon honor. 6. Ignorance is the generator of crime and vice, producing the worst consequences where it prevails. 7. The safety of society can only be conservated by enlightened citizens, and are jeopardized by the malignancy growing out of general ignorance. 8. It is impossible to over-estimate the social value of making workmen good and useful citizens. 9. So to elevate a large class, gives stability to schools and institutions for moral and intellectual culture. 10. Working men constitute a large majority of our people, and whatever lifts them up in the social scale is important to the whole community. 11. In numerous eastern cities and towns, the benign efforts of cultivating the industrial class are visible in good order and the general moral tone of society. 12. It is, manifestly, a primary duty of employers, to themselves and to society, to give preference to workmen of intelligence and morality; where such qualities are uniformly preferred, those who possess them not will strive to attain them, and they will form an essential qualification in preparing youths for employment.

THE Providence Tool Company are making 600 guns a day for the Turkish Government.

THE NEW GRAIN ELEVATOR IN NEW YORK CITY.

As it is now manifest that the war in Europe is destined to render this country the principal source of grain supply to foreign markets, it also is apparent that increased facilities for handling grain will become needed at all points of shipment. Inventions, therefore, tending to improve upon present methods of loading and unloading cereals are, or soon will be, the subject of especial demand. As there is an excellent field for inventive work in the present form of grain elevator, we have prepared the annexed series of engravings from the fine building of this class, recently completed by the New York Central and Hudson River Railroad Company, at the foot of 60th Street and North River, this city, which conveys a good general idea of probably the most improved machinery, etc., now employed for grain transhipment and storage. There are other elevators in the country much larger than the one here referred to; but the latter, constructed under the engineering direction of Mr. Charles Hilton, is practically a combination of the best results of experience as exhibited in the principal older structures in Boston, Chicago, Baltimore, and elsewhere.

The building is of wood, with an exterior envelope of brick. It is 354 feet in length by 100 feet in width, and measures 154 feet in height to the peak of the roof. It is erected on made ground, some 7,000 piles having been driven into the river bed at intervals of 2 feet 9 inches between centers. These are cut off below low water level, filled in with sand, and transversely capped with heavy timbers. Two diagonal cappings follow above, and a series of granite piers, pyramidal in shape, finally support the ponderous timbers which sustain the bins. Of the latter there are 7 rows, 33 in each row, making 231 in all; and there are shipping bins in addition. There are 182 large bins, measuring 9 feet by 13 feet 3 inches by 72 feet deep; others are variously subdivided to make smaller receptacles. The walls of the bins are of 2 inch planks laid flat, and strongly spiked together, the width of the boards making the wall thickness. The total capacity of the bins is 1,500,000 bushels.

We shall now trace the progress of the grain from the time it enters the building on the cars until the final delivery into the vessels. Four tracks enter the building at the north end; and between the outside pairs twenty-two receiving pits are arranged, the disposition of one of which is shown in Fig. 1. Each receptacle is a huge wrought iron tank, sunk in masonry and lined with boards. Each has two hatches with hoppers, abreast of which the doors of the freight cars are brought. The grain is then removed from the cars by steam shovels operated by simple overhead mechanism. By this means the unloading is very rapidly accomplished; and the grain slides down the inclined side of the pit until it meets the lofting elevator leg, the foot of which descends to the lowest point of the pit. Here is a valve adjusted by a wheel above (shown in the hands of the workman), which checks the supply of grain to the buckets in accordance with the nature of the material, as some grain is taken up much more rapidly than other kinds. The lower portion of the elevator legs—there are eleven in the building—is made of plate iron from the foot to the bottom of the bins; through the bins, 2 inch pine planking is used. Each elevator has a 22 inch six-ply gum belt, on which the buckets are attached at intervals of a foot.

As the grain reaches the bottom of the receiving pit, it is scooped up by the buckets and carried to the uppermost garret of the building. Here we have followed it in Fig. 2, which represents the long perspective of lofty elevator heads. The elevator belt here passes over a 6 foot pulley, the journal of which has a hinged bearing, so that the pulley may be raised and lowered by means of a lever and cord. In this way it is brought into or out of contact with a friction pulley on the main driving shaft. A part of the heavy bevel gearing by which power is transmitted from shaft to shaft is shown in the foreground of the engraving. The friction pulley referred to is made of brown paper pressed in between iron disks, 2 feet in diameter; its face also measures 2 feet.

The grain in the buckets is carried over the large pulley and is at once discharged into a weighing hopper, Fig. 3, on a floor below. This hopper stands on an 18 ton scale; and as fast as the grain within it is weighed, a valve is opened by which the grain escapes through the swinging spout on the next floor below, shown in Fig. 4. This spout may be turned by hand, so as to eject the material into any one of the open conduits, the mouths of which are placed around the cir-

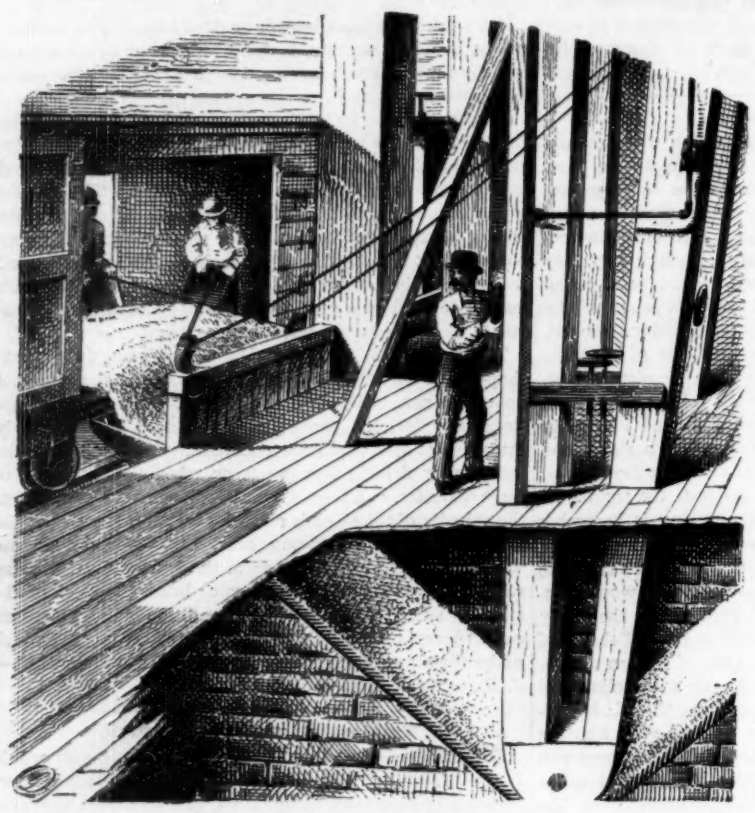


Fig. 1.—TAKING GRAIN FROM THE CARS.

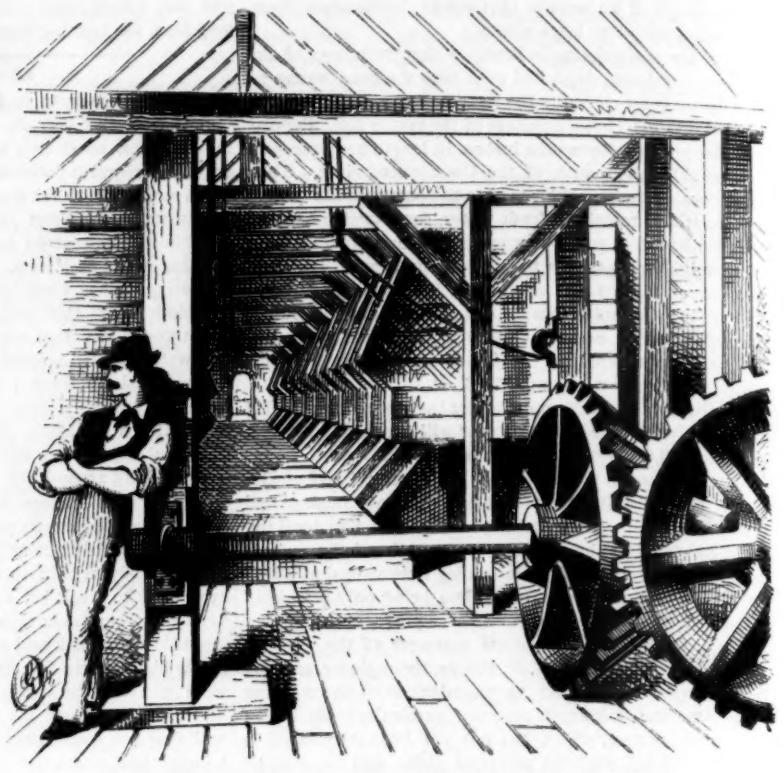


Fig. 2.—THE HOPPERS AT THE HEADS OF THE ELEVATORS.

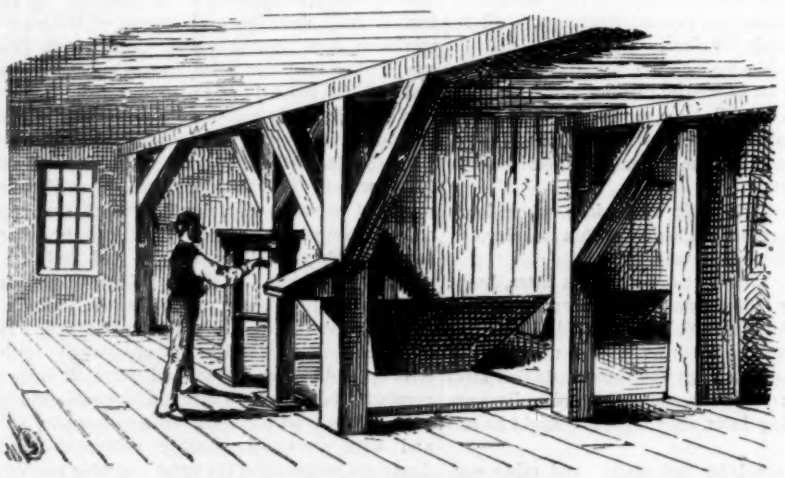


Fig. 3.—THE WEIGHING HOPPER.

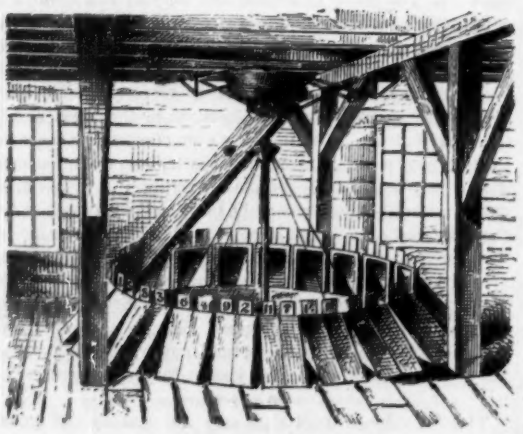


Fig. 4.—THE SWINGING SPOUT.

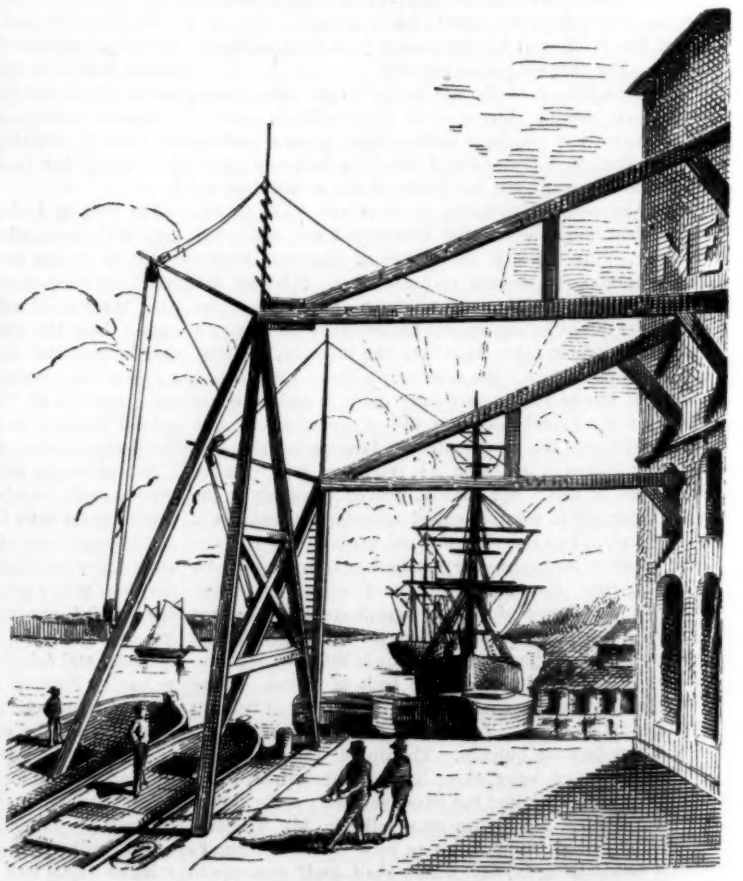


Fig. 5.—LOADING THE VESSELS.

cumference described by its lower extremity. As all the bins are numbered, and as each conduit bears a similar number to the bin to which it leads, it is merely necessary to adjust the spout to any desired opening to divert the grain to the proper bin. A blackboard, painted on a partition, is divided into numbered squares corresponding again with the bin numbers; and in each square a record is kept of the contents of the bin, so that the person in charge can see at a glance just where the incoming grain may be stored.

The grain, now being in the bins, is there left until it becomes necessary to load it aboard vessels or otherwise prepare it for transportation. If the vessels are to take it in bulk, the grain is allowed to escape from the bins through spouts

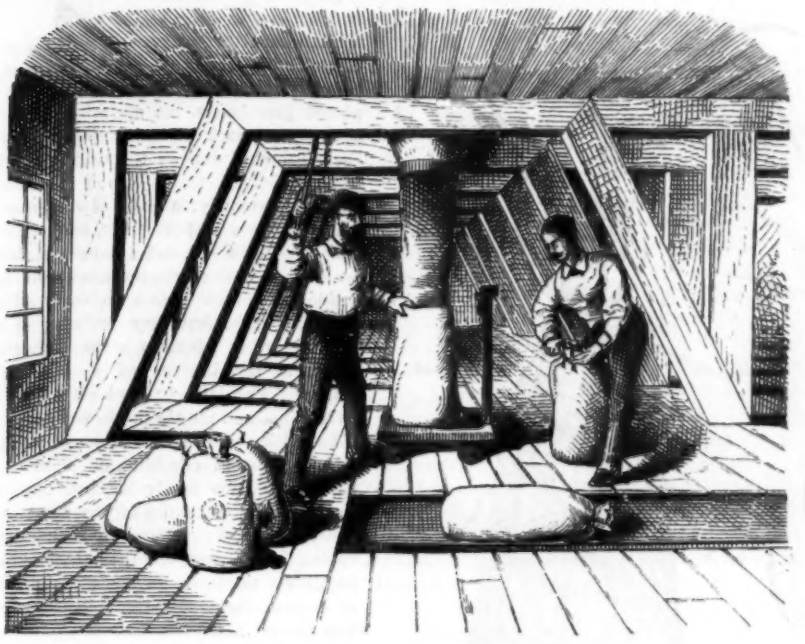


Fig. 6.—THE BAGGING FLOOR.

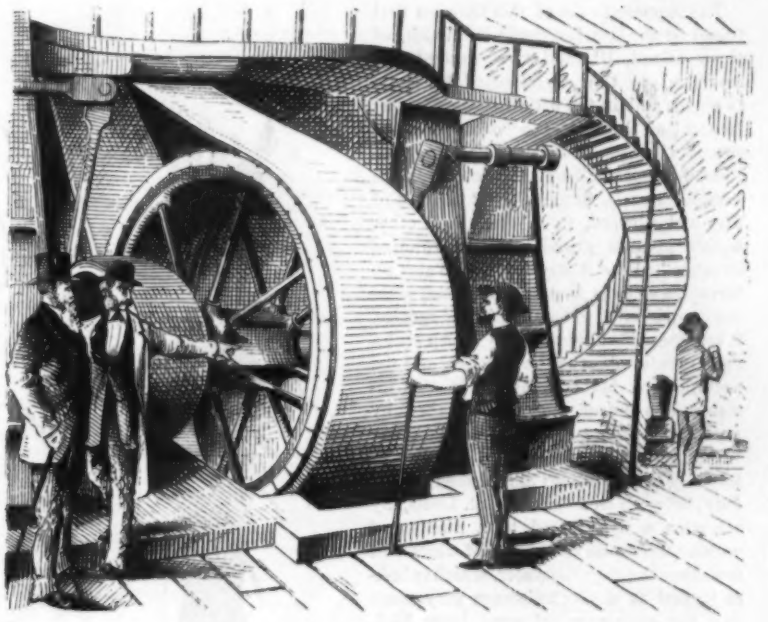


Fig. 7.—THE STEAM ENGINE.

back into the receiving pits. Hence it is re-elevated to the top of the building, and passes first into a weighing hopper and then into a shipping hopper immediately below. By thus using two hoppers, the delivery of the grain is rendered continuous, as, while the weighing hopper is being filled, the shipping hopper may be emptying into the spout which leads down outside the building and thence directly into the vessels, as shown in Fig. 5. If, however, the grain is to be bagged, then, instead of going down into the receiving pits, it is drawn off by a simple valve to the bottoms of the bins directly into the sacks. The floor directly beneath the bins is thus known as the bagging floor, Fig. 6. As soon as a workman fills a bag, he closes the valve and places another bag in position. Another operative ties the first bag, and places it on the conveyer, which is a large rubber belt running in an opening and level with the floor. This transports the filled sack to the side of the building, and throws it off upon an inclined trough, down which it slides and emerges through an opening in the wall upon a wagon placed to receive it.

Figs. 7 and 8 represent the engines and the immense main driving belt. The engines are two direct-acting, vertical, inverted, with cylinders 34 by 34 inches. The average pressure is about 60 lbs. of steam. The belt, Fig. 8, is the largest in the country, measuring 4 feet in width and 331 feet in length, and weighing 2 tons.

Electricity in the Production of Galvanic Deposits and of Chemical Decomposition.

All who are acquainted with electro-magnetic machines know that the maximum of effect produced corresponds with the moment when the current is best closed, and the minimum with that when it is most open. The author was led to think that electrolysis might derive advantage from this principle. Hitherto, when desirous of effecting a metallic deposition or a chemical decomposition, a single bath has been used, into which were plunged two anodes more or less closely approximating. That is to say, we have placed ourselves in conditions approaching those of the least electric resistance and the maximum of effort. The author has therefore multiplied the baths, taking care to connect their anodes, as is done with the elements of a battery arranged for tension. The result was that the totality of metal deposited increased with the number of baths.—*M. Arn. Thenard.*

Adulteration of Bread and Flour with Gypsum, Heavy Spar, Etc.

A Rotterdam firm has been recently offering finely ground gypsum to various millers in the province of Hanover. To detect such frauds Vohl mixes 10 grains of the flour with 20 grains of potash saltpetre, places the mixture in a platinum vessel, and ignites with a redhot platinum wire. If the flour is pure the pale green melted mass dissolves almost entirely in water, and the solution, scarcely turbid, gives no precipitate with hydrochloric acid, which, if it appears, indicates the presence of silicates. The acidulated solution should give with barium chloride merely a slight turbidity. A decided precipitate indicates the presence of sulphate of lime or of baryta.

Blowpipe Apparatus.

A prize of $50, which has been placed at the disposition of the Council by Colonel A. A. Croll, is offered by the Society of Arts, with the Society's silver medal, for the best set of blowpipe apparatus which shall be sold retail for $5. The apparatus must, at least, contain blowpipe, blowpipe lamp or candle, spirit lamp, charcoal or charcoal pastilles and holder, platinum wire, glass tubes closed at one end (mattresses), open glass tubes, platinum-tipped forceps, magnet, hammer and anvil, and four reagents, namely, borax, microcosmic salt, carbonate of soda, and nitrate of cobalt. These instruments and reagents, together with any other which may be thought desirable, must be packed in a box. It must be understood that the above list of apparatus, etc., is only intended to include such as are absolutely indispensable, and it is expected that the set will contain additional instruments and reagents, the selection of which is left to the competitors. Special attention should be paid to the following points: 1. Solidity of construction. 2. Compactness and portability. 3. Facilities for packing and unpacking. 4. Number of useful instruments and reagents in addition to those mentioned. The Society does not engage to give the

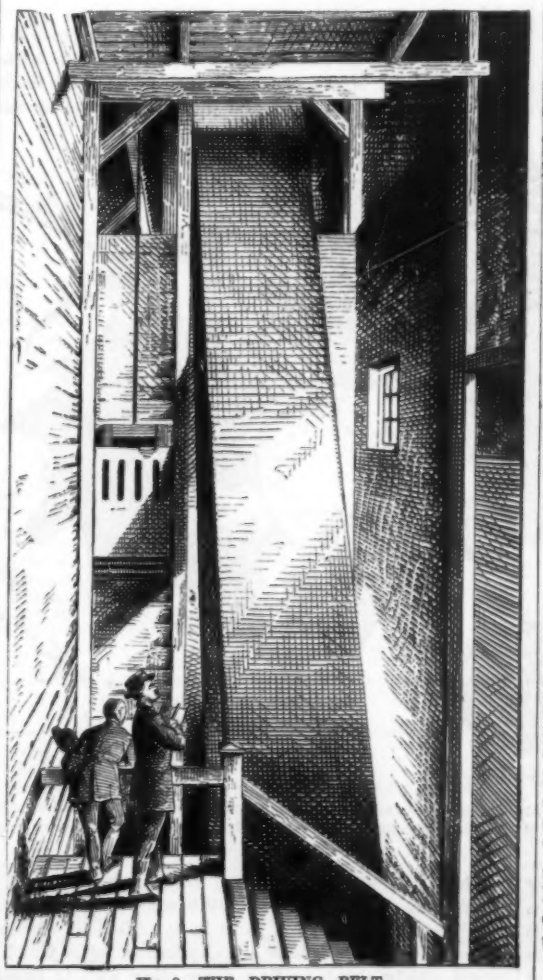


Fig. 8.—THE DRIVING BELT.

prize unless some apparatus appears to show sufficient merit, and some advance in merit on what is now obtainable for $5. All apparatus for competition must be sent to the Society's House, London, on or before the 1st of August, 1877. The successful competitor must guarantee that a proper supply of the apparatus shall always be kept on hand, for sale in England.

Milk and Butter.

There are no farmer's productions, says the *Maryland Farmer*, so subject to injuries from many slight causes as milk and butter, and none so sensitive to unpleasant odors of every kind; none that is so much and as readily deteriorated in value as these are. Hence, all kinds of uncleanliness should be avoided, and the utmost neatness should be observed in every step of their production and marketing, from the very feeding, handling, and milking of the cows, as well as treatment and handling of the milk, with the churning, working, and putting up of the butter. All of the implements used, the water and salt used, and the rooms occupied in keeping the milk and making the butter, should be kept perfectly clean and sweet, in order to produce the best quality to secure high and fancy prices. No article that the farmer produces for the market has such a wide range or difference in price as butter, not even cheese or choice fruit. We see by quotations in all the great butter markets that the prices of eating butter range all the way from $1 to 10 cents per lb., while greasy, cooking butter is even lower than that; even the packages in which it is put up, whether firkins, pails, tubs, or rolls, affect the prices for which it sells. Grains and meats have but a small range compared to butter; the difference in the prices of butter is much greater than the difference in the cost; hence, it is much more profitable to make and sell a first-class article than a poor one.

Greasing Axles.

On the authority of the *Carriage Monthly*, more injury is done to carriages and wagons by greasing too much than the reverse. Tallow is the best lubricant for wood axles, and castor oil for iron. Lard and common grease are apt to penetrate the hub, and work their way out around the tenons of the spokes and spoil the wheel. For common wood axles, just enough grease should be applied to the spindle to give it a light coating. To oil an iron axle, first wipe clean with a cloth wet with turpentine, and then apply a few drops of castor oil near the shoulder and end. One teaspoonful is enough for the four wheels. Carriages are sometimes oiled so much that their appearance is spoiled by having the grease spattered upon their varnished surfaces. When they are washed in that condition, the grease is sure to be transferred to the chamois from the wheel, and from thence on to the panels.

The Cockroach Utilized.

In Russia the common cockroach (*blatta orientalis*) is a favorite popular remedy for dropsy. Dr. P. Bogomolow, of St. Petersburg, has lately examined its effects in nine cases of Bright's disease, heart disease, and other affections accompanied with severe dropsy, and in all the result was the same. There was an increase in the secretion of the urine and perspiration, with rapid disappearance of œdema, and also almost complete disappearance from the urine of albumen and renal derivatives. The dose was five to ten grains of the powdered cockroaches in the twenty-four hours, but they were also administered as a tincture and as an infusion. These insects do not, like cantharides, says the Boston *Journal of Chemistry*, produce any irritant action on the kidneys. Dr. Bogomolow has succeeded in extracting from them a crystalline body which he calls antihydropin, and which is their active principle.

Detection of Oleomargarin in Butter.

Professor G. Lechartier says that fresh genuine butter which has not been melted appears under the microscope composed of ovoid granules, and contains no crystals. The artificial product obtained from tallow contains crystals. Artificial butter does not melt at once, like genuine butter, to a clear oil, but fuses gradually, a whitish "sauce" being first formed.

THE HELLGRAMMITE.

BY PROFESSOR C. V. RILEY.

Few insects excite more curiosity than the gigantic fly (*corydalus cornutus*, Linn.), to which I desire to introduce the readers of the SCIENTIFIC AMERICAN. It is our largest *neuropteron*, or nerve-winged insect, belonging to the family *sialida*. Of not unfrequent occurrence over the Atlantic, Middle, and Western States, it is most often met with along water courses, and is vulgarly called the "hellgrammite" in the Mississippi Valley; and this cognomen, the origin of which is somewhat obscure, has been generally adopted by entomologists. There is a certain formidable look about the creature: and though it is absolutely harmless, a great many people have a superstitious dread of it.

The supposed eggs of this fly were first found by the late Benjamin D. Walsh, of Rock Island, Ill., and were figured and described in the *American Entomologist* (Vol. I.), and in the fifth "Entomological Report" of the writer, as "oval, about the size of a radish seed, of a pale color with some dark marks," and "deposited in the summer months in closely set patches of fifty and upward, upon reeds and other aquatic plants growing along running streams." How it was that Mr. Walsh referred these eggs so confidently, and without qualification, to this particular species, it is impossible now to say. Walsh was a most careful observer and writer, and the accuracy of his conclusions in this instance was never questioned either by myself or others. Yet the eggs of our hellgrammite are, in reality, totally different. In passing up the Mississippi last July, between Bushberg and St. Louis, my attention was attracted to a number of white splashes on the leaves of vines and trees overhanging the water, which splashes looked at a short distance very much like the excrement of some large bird. But upon closer inspection each splash had a more or less regular, circular or oval bulging about the middle; and upon procuring some of the leaves thus laden, a glance sufficed to show that each swelling was in reality an egg mass. Within the distance of a mile I obtained over thirty of these egg masses, there usually being one to a leaf, and that on the upper side, but sometimes three or four, and in one instance eight—five on the upper and three on the lower surface. They were found alike on cottonwood, sycamore, elm, and grape vine, but in every instance on leaves over-hanging the water, thus indicating that they belonged to some aquatic animal, and that the leaf was but a temporary place of attachment. The mass is either broadly oval or circular in circumference, flat on the attached side, and plano-convex on the exposed side. It averages 21 millimeters (⅘ inch) in length, and is covered with a white or cream-colored albuminous secretion, which is generally splashed around it on the leaf or other object of attachment.

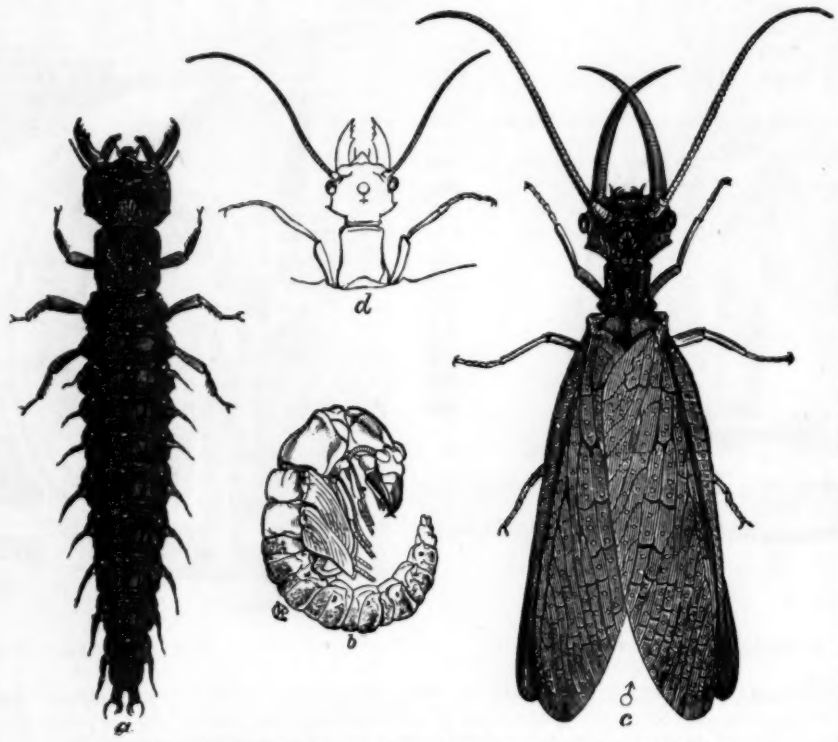


Fig. 1.—HELLGRAMMITE:—*a*, full grown larva; *b*, pupa; *c*, male fly; *d*, head of female fly.

Each mass contains from two to three thousand eggs, the outer layer forming a compact arch, the eggs placed side by side with the anterior ends inside, and the hind ends showing like so many faint dots through the white covering. Those of the peripheral row lie flat upon the object of attachment, and the others gradually diverge at their outer or hind ends, so that those in the center of the arch are at right angles to said object. Beneath this vaulted layer the others are packed on a plane with the object, those in contact with it arranged in concentric rows, the rest packed in irregularly. Each egg is $\frac{1}{20}$ inch long, about one third as wide, ellipsoidal, translucent, sordid white in color, and with a very delicate shell; and each is surrounded and separated from its neighbors by a thin lining of the same white albuminous substance which covers the whole. Before hatching, the color of the eggs deepens into fuliginous, and contrasts more strongly with the intervening white. Now the nature of these eggs not only puzzled myself but every prominent entomologist in the country to whom I referred them. The eggs of all the larger water beetles are known and described, and those of our hellgrammite were also supposed to be. There is a large water bug (*belostoma grandis*), but these eggs were evidently not heteropterous. No dipterous insect was large enough to produce them, and the *hymenoptera*, *lepidoptera*, and *orthoptera* were out of the question. In fact, Walsh's blunder threw me off the track, and I had to patiently await development. Presently, to my great joy, the young began to hatch; and being perfectly familiar with the full grown larva of *corydalus* in all its details, I at once recognized this species in my young curiosities. For the first time it struck me that Walsh had made a mistake. An examination of the contents of the abdomen of a gravid hellgrammite in my cabinet at once settled the question, and made it manifest that the eggs that had just hatched belonged, without any question, to this gigantic fly.

As to the nature of the eggs that have hitherto been mistaken for them, and which are represented in Fig. 3, we can only surmise. The specimen from which the engraving was made was destroyed with the Walsh cabinet in the Chicago fire; but I have a clear recollection of them, and am of the opinion that they belong to the large water bug (*belostoma grandis*), the eggs of which are still undescribed.

The full grown larva of our hellgrammite is well known to fishermen, who, in this part of the country, call it a "crawler," and esteem it as bait. It measures from three and a half to four inches in length, is of a dark brown color variegated with light brown, the abdominal joints being tough and leathery, and the head and thoracic joints horny and polished. Though this larva can live for some time out of water, even when young, yet until it attains its growth it is strictly aquatic, abounding most in rapid-flowing streams, and especially such as have a rocky bottom, upon which it crawls slowly about, feeding upon other aquatic insects. Mr. J. H. Comstock, of Cornell University, who has been making some interesting anatomical studies on this insect, generally finds it in the most rapid portions of the streams about Ithaca, where it dwells mostly under stones. He has captured numbers by turning over large stones, and allowing the current to wash the larvæ into a dip net; and he is of the opinion, which my own observations support, that the species live three years in this larval condition. Most aquatic larvæ transform to the pupa state within the water, but this larva quits the water when full fed, as do the others of the same family, and crawls about for days seeking a place wherein to transform. We find, therefore, that Nature has abundantly fitted it for living in both elements, by giving it, first, two rows of nine breathing holes or spiracles, placed in the usual way along the sides of the body, which enable it to breathe out of the water;* and, secondly, two sets of nine gills or *branchiæ*, in the shape of lateral slightly hairy filaments which enable it to breathe in the water. These gills or respiratory filaments are placed just below the spiracles, one on each side of each abdominal joint, except the ninth, and one on the terminal sub-joint. Besides these lateral filaments there is, ventrally, a pair of rust-brown spongy masses of short fibers, one on each side of joints 4—10, and a somewhat similar central patch on the terminal joint and sub-joint. These have been regarded as accessory gills, but they probably assist the creature in adhering to the surface of stones at the bottom of swift-flowing waters. The lateral filaments assist in swimming, and the tip of the body is provided with a pair of curved double hooks, which assist in climbing, or in moving backward. The newly hatched larva is almost colorless, and has the structural characters of the full-grown individuals, except that the legs and the branchial filaments are relatively longer, and the body of more uniform diameter. The sponge-like ventral masses of fiber are, however, obsolete, and the lateral filaments are smooth and not hairy. In hatching, the young do not gnaw through the vaulted covering, but creep from beneath the sides of the mass, which is somewhat loosened and raised by their pressure. They at once drop from the leaf, and crawl actively, with tails hoisted in the air, over whatever surface they may fall upon. It is doubtless their habit to drop at once to the water and sink to the bottom, where they can anchor by means of the anal hooks, or find lodgment under some stone or rock. In an aquarium, in which I endeavored to rear and study them, they would float readily, with the body curved in the water and the head bent so as to rest at the surface. They also swam readily by sudden jerks of the body, especially by striking the abdomen beneath, very much resembling the actions of the common mosquito wriggler in descending, but ascending head foremost, more like the pupa of that species. They did not seem to need to rise for air, and would congregate most at the bottom of the aquarium, and under such stones as were placed therein.

Fig. 3.—Supposed eggs of corydalus.

They none of them could be made to survive more than three days in such standing water, and the necessity of fresh running water to their well-being will always render difficult the study of the insect in its infancy.

After leaving the water, about the beginning of June, this larva travels, in the night-time, sometimes to comparatively great distances, having been found nearly a hundred feet from its former *habitat*.

Mr. Walsh mentions a most curious incident in connection with its larval wandering, which I quote in full:

"A most respectable man, who keeps the toll bridge over Rock River, where this insect is very abundant, informed me that on several occasions its larvæ had fallen down one of his chimneys. His idea was that they must have bred there, but that, of course, is out of the question. The statement was confirmed by his wife, and I have no doubt of its truth. In 1863, I threw a larva of this insect into the Mississippi to examine into its customary mode of progressing in the water, which, as I found, was by crawling along the bottom, not by swimming. As it emerged from the water, it climbed with ease up the stump of a large white elm, which was stripped of its bark, and as smooth as any carpenter could have planed it. The stump was three feet high and upright, and when

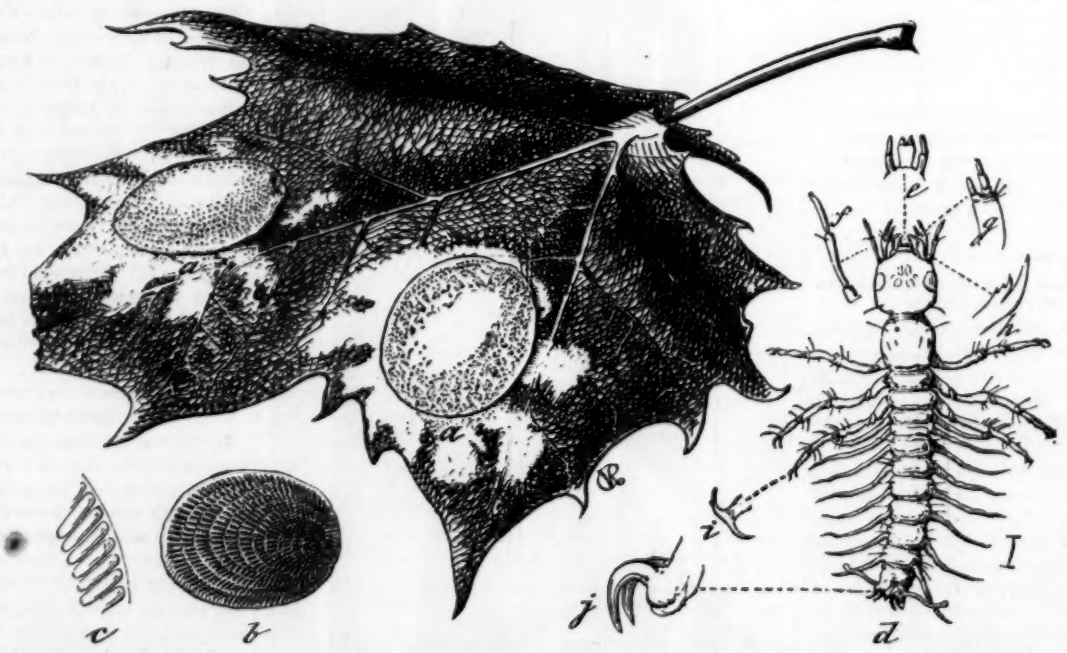


Fig. 2.—HELLGRAMMITE :—*a a*, egg masses attached; *b*, same from beneath, just before hatching—natural size; *c*, a few outside eggs enlarged; *d*, newly hatched larva; *e*, labium; *f*, antenna; *g*, maxillæ; *h*, mandible; *i*, tarsal claw: *j*, anal hooks—all greatly enlarged.

* Mr. Comstock has found an additional pair of rudimentary spiracles on the hind part of a prominent fold between the mess and metathoracic joints.

it had reached the top it commenced descending on the opposite side; but, after a while, lost its foothold and fell into the water again. The pair of two-clawed appendages at the tail are used with much effect to assist it in climbing. The building which it must have climbed to reach the chimney, down which it is stated to have fallen, was only a low, one-story wooden one."

This larva can pinch with its formidable-looking jaws, but not forcibly enough to draw blood. In preparing for the pupa state, it burrows into the earth, where it forms an oval cell; or it hides under some large stone, piece of wood, or other substance. Here, in about two weeks, it casts its tough larval integument and assumes the pupa form, lying in a curved position in its cell, with the head, wing-pads, and legs deflexed on the breast. The color is yellow, with traces of the brown mottlings of the larva and of the lateral filaments. The spiracles are more conspicuous, and the upper jaws stronger than in the larva, and olive green. The pupa state lasts but a few days, and the perfect insect issues during the month of July. It is nocturnal in habit, and hides, for the most part, in obscure places during the day. It is sluggish at this time, and, if approached, will drop sooner than fly, or raise its head and abdomen and open its jaws menacingly.

The sexes differ greatly in this perfect state. The male is remarkable for having his upper jaws—which in the female are normal and fitted for biting—prolonged into incurved, prehensile appendages of the form of a grain cradle finger, and smooth and cylindrical, except at the tips, which are pointed, and minutely notched. As I have shown in my 5th report, there is no perceptible sexual difference in larva or pupa, unless it is, as stated by Haldeman, in the rather larger size of the jaws of the male. This feature cannot, however, be relied on. This similarity of the sexes, especially in the pupa, is the more remarkable that in the imago state they differ so greatly. The subsequent modification of the male jaws is assumed at the last molt; and if the jaws of a male pupa be dissected, the future finger-like jaws will be found crowded within them, like the "wrinkled finger of a glove pushed into a thimble," as Mr. Comstock expresses it. This modification in the male is evidently to enable him to embrace the soft body of the female, as it cannot well have any other use. The body of the hellgrammite is soft, and were the jaws of the male horny, and armed with teeth, in securing the female they would injure her, and thus defeat rather than aid procreation. In the large stag beetle or "buck-bug" (*lucanus elaphus*, Linn.), on the contrary, where both sexes have very hard, horny bodies, the upper jaws in the male are greatly prolonged, but very stout, and armed with sharp prongs, the better to enable him to seize the female.

In these two cases we see how wonderfully the homologous organs have been modified in opposite directions to accomplish the same end. We find in Nature innumerable such curious contrivances and modifications, which at once excite our wonder and admiration. To quote Mr. Walsh's own eloquent words: "In so elaborate and diversified a manner does Nature adapt her plans and patterns to the ever-varying conditions of animated existence; and with such consummate care has she provided that the great fundamental law shall everywhere be carried out: 'Increase and multiply and replenish the earth.'"

It is worthy of remark that in both these large insects, in which the male upper jaws are so modified, this sex is far more common than the other. It is probably owing to the fact that the female seldom wanders away from her breeding place, and is, therefore, less often seen than her more restless and adventurous mate.

The Allen Governor.

The Allen governor, an extended illustrated description of which we published some time ago, is meeting, we are gratified to learn, with the substantial success to which, through its many merits, it is justly entitled. Over 2,000 of these governors are now in operation in this country and abroad, and the demand is constantly increasing. The manufacturers exhibit a series of testimonials, from those who have the machine in use, on all sorts of engines and under a great variety of conditions; and there seems to be but one opinion as to its great sensitiveness and general efficacy. We see from an advertisement in another column that agents are desired for the sale of the governor.

On the Estimation of Alum in Bread.

"For a long time past the old Normandy or soda process for the estimation of alum in bread, has been condemned on account of the great difficulty experienced in re-dissolving the aluminic hydrate or phosphate, after its precipitation, together with tri-calcic phosphate, etc. This has led to the production of several processes, most of which are very complicated. By a slight modification in the usual method of procedure, the Normandy method can be rendered as accurate in its results as any of those which have replaced it. This consists in adding the boiling acid solution of the charred bread to a boiling solution of sodic hydrate, containing a large excess. I proceed as follows: 1,000 grains of bread are burnt down to a small bulk, powdered with about 100 grain measures of hydric chloride, and warmed for a few minutes; about two ounces of water are then added, boiled for five minutes, filtered, etc. A solution containing about 250 grains of pure sodic hydrate is made in a very little water; and to this solution, when boiling, is very cautiously added the boiling acid solution of the charred bread, the whole boiled for a few minutes, filtered, and washed. The filtrate, after the addition of a few drops of a concentrated solution of disodic phosphate, is slightly acidified with hydric chloride, and subsequently rendered just alkaline with ammonic hydrate and boiled. The precipitate is collected, washed, and weighed as aluminic phosphate.

"To test the accuracy of this method, I had four loaves of bread made in my kitchen, one with no alum, the others with varying quantities. Care was taken to leave as little as possible of the dough adhering to the sides of the vessel in which it was made, so that each loaf contained, practically, all the alum that was dissolved in the water with which it was made. The loaves were weighed when one day old, and 1,000 grains taken of each:

	Weight of loaf.	Grains of alum put in.	Weight of Al. PO^4 from 1,000 grains.	= grains of alum in loaf.
1..	2 lbs.	0	0·07 grains.	3·50
2..	1½ lbs.	10	0·32 grains.	12·39
3..	2 lbs.	20	0·46 grains.	23·80
4..	2½ lbs.	40	0·76 grains.	44·20

"It will be seen that the method leaves nothing to be desired in point of accuracy, and will favorably compare with any other in respect to simplicity.

"Since devising the above process, I have been informed by Mr. Heisch that he, and he thinks others, have for many years applied the same principle (namely, the addition of the acid solution to an excess of boiling alkali) to the separation of aluminic hydrate from other gelatinous precipitates, having found it impossible completely to re-dissolve the aluminic hydrate by any amount of sodic hydrate if it were once precipitated."—*W. C. Young, F.C.S., in The Analyst.*

Mount Carmel, Ill, Destroyed by a Tornado.

The town of Mount Carmel, Ill., was visited on the 4th instant by a terrible tornado, which laid nearly the entire place in ruins. About 20 business houses and 100 residences were either destroyed or badly damaged by the fury of the gale, and by the fires which broke out at various points. The storm came from the southwest, and, from its track, seems to have been a cyclone traveling at an estimated velocity of 150 miles per hour. During its prevalence, the air was filled with flying roofs, lumber, clothing, etc., some of the *débris* being carried miles away. Thirteen persons are reported as killed, many others injured, and some seventy families were rendered homeless. The loss of property is said to amount to nearly $500,000. No warning whatever was afforded of the approach of the storm. It seems to have struck the town and to have passed over it within two minutes, preceding a heavy rainfall.

Mount Carmel has about 3,000 residents, and her industries were largely mechanical. The SCIENTIFIC AMERICAN has many subscribers among those who have been afflicted, for all of whom we have the heartiest sympathy.

The Meeting of the American Association for the Advancement of Science.

The twenty-sixth meeting of the American Association for the Advancement of Science is to be held at Nashville, Tenn., on August 29. Sessions will take place in the Capitol. Special arrangements are being made for decreased railroad fares, etc., and for the accommodation of members in the city. The permanent subsections of chemistry, microscopy, and anthropology are to be continued, and the co-operation of students of these sciences is requested. The Entomological Club will meet on the day preceding the meeting of the Association.

Inventions Patented in England by Americans.

From May 15 to May 24, 1877, inclusive.

BATH OVERFLOW, ETC.—Valve and Faucet Company, New York city.
BOOK.—J. Clemens, Hartford, Conn.
BOOT-NAILING MACHINE.—L. R. Blake, Boston, Mass.
BOTTLE STOPPER.—N. Thompson (of Brooklyn, N. Y.), London, England.
CAR COUPLING.—E. Miller, New York city.
ELASTIC BAND.—F. Armstrong, Bridgeport, Conn.
LAMP.—J. H. Lewars, Philadelphia, Pa.
LAMP.—N. L. Rigby *et al.*, Winfield, Kan.
METAL CARTRIDGE SHELLS.—J. H. Bullard, Springfield, Mass.
MOTOR FOR ROCK DRILLS, ETC.—E. S. Winchester *et al.*, Boston, Mass.
ORNAMENTING GLASS, ETC.—S. M. Adams, New York city.
PAPER BOX, ETC.—E. B. Beecher, Westville, Conn.
PARING FRUIT, ETC.—W. H. Goodchild *et al.*, New York city.
PORTABLE BOAT.—C. A. Fenner, Mystic River, Conn.
POSTAGE STAMP, ETC.—A. B. Foster, Providence, R. I.
POSTAGE STAMP, ETC.—J. Sangster *et al.*, Buffalo, N. Y.
REFINING STEEL, ETC.—J. E. Sherman, Boston, Mass.
SCISSORS.—C. M. Meserole, New York city.
SCREW MACHINERY.—E. Nugent, Brooklyn, N. Y.
SCREW-THREADING MACHINERY.—S. S. Townsend, Philadelphia, Pa.
SCREW WRENCH, ETC.—B. L. Walker, Sing Sing, N. Y.
SEWER GAS TRAP.—B. P. Bower *et al.*, Cleveland, Ohio.
SEWING MACHINE.—L. Dryfoos, New York city.
SPLINT.—D. Ahl, Newville, Pa.
TORPEDO APPARATUS.—H. S. Ross (of Chicago, Ill.), London, England.
TOY HORSE.—J. H. Nolan, Boston, Mass.
TREATING SLUDGE OIL.—W. P. Jenney, Brooklyn, N. Y.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

PATENT STONE-CRUSHING MACHINE.—JOHN ROBERTSON, CHARLES C. MARTIN, AND AUSTIN H. SMITH, APPELLANTS, *vs.* ELI W. BLAKE. ELI W. BLAKE, APPELLANT, *vs.* JOHN ROBERTSON, CHARLES C. MARTIN, AND AUSTIN H. SMITH.

[Appeals from the Circuit Court of the United States for the Eastern District of New York.—Decided October term, 1876.]

The patent granted to Eli W. Blake for a stone breaker, June 15, 1858, reissued January 9, 1866, and extended June 15, 1872, is not anticipated by the earlier patent to Hobbs and Brown for "improvements in the application of well known mechanical means for the purpose of crushing ice," and to Hamilton for "crushing and grinding quartz or other substances," they not containing any of the essential element of Blake's invention.

The substitution of one part of the operating mechanism, of a combination the equivalent of that omitted, does not avoid an infringement.

When an original machine and an improvement upon it are both patented, neither patentee can use what does not belong to him without the requisite authority from the owner.

The complainant was found entitled to nominal damages only, the burden of proof being upon him; and it appearing that the proof was meager and indefinite, but four machines made, no established license fee, the profits made being due in part to inventions covered by other patents, and no distinction made between profits accruing from the use of complainant's invention, and that from the other inventions and manufacturers' profits.

Mr. Justice Swayne delivered the opinion of the court:

These are cross-appeals in the same cause. Both involve questions in mechanics. These being determined, the legal propositions which apply are so well settled as to admit of no controversy.

A patent was granted to Blake on the 15th of June, 1858, by the United States, for a stone breaker. On the 9th of January, 1866, the same authority reissued the patent to him, with amended specifications. It was extended on the 15th of June, 1872. The bill in this case is founded upon the latter patent. It charges infringement.

The answer avers that the machine described is of no practical utility, denies the novelty of the invention, and also the alleged infringement.

The description in the specification sets forth three things as the essential characteristics of the machine:

(1.) Two jaws within which the stones are to be broken. Their faces are to be so nearly in an upright position that the stones will descend between them automatically. The jaws are to be so far convergent that the interspace at the top will be sufficient to receive the stones, and that at the bottom only such as will allow the fragments to escape when broken of the required size.

(2.) A revolving shaft driven by steam or other motive power, imparting to one of the jaws a continual vibratory movement, causing it alternately to approach toward and recede from the other jaw, through a short and definitely limited space, so that when a stone is put in the movable jaw will advance and crush it, then receding liberate the fragments, which again descend, and, if too large, are rearrested and crushed again, and so on until the fragments have passed out through the open space at the bottom. The distance between the jaws is to be adjustable at pleasure, so that the stone can be broken of any desired size.

(3.) A flywheel is combined with the revolving shaft and movable jaw for the purpose of rendering the strain upon the power more equal.

The claim is for—

A combination of a stone-breaking machine of upright converging jaws with a revolving shaft and mechanism imparting a definite reciprocating movement to one of the jaws from the revolving shaft, the whole being and operating as set forth.

The combination in a stone-breaking machine of the upright movable jaw with the revolving shaft and flywheel, the whole being and operating as set forth.

In combination with the upright converging jaws and revolving shaft, imparting definite limited vibration to the movable jaw, so arranging the jaws that they can be set at different distances from each other at the bottom, thus producing fragments of every desired size.

A moment's glance at the model furnishes a sufficient answer to the objection of the want of practical value. It would be passing strange if a machine of that character could have gone through the severe conflicts of litigation which this patent has encountered and have come forth victorious from every contest. It has proved equal to every ordeal to which it has been subjected. The number sold by the complainant, as shown by the record, is conclusive upon the subject.

The patent to Hobbs & Brown of the 4th of September, 1849, and the patents to Hamilton of the 30th of January, 1854, and the 5th of January, 1855, antedate the patent to Blake. It is insisted that each of them is for a machine substantially the same with the one described in Blake's patent, and that they are fatal to his claim of the requisite novelty of his alleged invention.

The machine for Hobbs & Brown is for—

Improvements in the application of well known mechanical means for the purpose of crushing ice. * * * The improvements consist in applying a hopper with one diagonal fixed side and two parallel sides to contain the ice, and compressing the ice by a movable fourth side, the fixed diagonal side and moving side having within them dental projections cut or cast on, to operate downward and prevent the ice from rising in the hopper when compressed, and also to enter and split the ice.

The machine is operated "by the combination with these parts of a lever fitted with an eccentric or cam-formed point."

There is in this description neither of the ingredients nor the compound of the Blake machine. Every element and the combination are both wanting. There is no mention of the converging adjustable jaws, of the revolving shaft, nor of the flywheel. The differences are as marked in the mode of operation as in the structural elements of the machine.

The Hobbs & Brown machine does its work by the downward and sweeping movement of the jaw and the grasping and splitting by the teeth. The motive power is supplied and applied by a hand lever, which gives a motion irregular and varying with the varying exigencies of the ice during the process to which it is subjected.

The Blake machine performs its functions by the short, regular, and unvarying vibrations of the smooth-faced adjustable jaw driven without intermission by the revolving shaft.

It is obvious that the Hobbs and Brown machine could not be applied with effect to the purpose of breaking stones without essential changes of principle and details.

Hamilton's machine was "for crushing and grinding quartz or other substances."

In the specification annexed to his original patent, he says:

My invention consists in the use of a cylindrical nut or pestle in a similarly formed basin, the pestle having a partial rotary and crushing motion communicated to it by means of a lever attached thereto.

A is a basin, the lower part of which is made circular, and the sides parallel to each other; *b b* are flat ends or heads secured to the basin by bolts. C is the shaft carrying the cylindrical pestle, *d*. E is a lever attached to or formed with the pestle, *d*, the upper end being connected by a joint, 2, to a pitman, passing to a crank, eccentric, or other suitable mechanical contrivance to give the arm, E, an oscillating movement, and the pestle a partial rotary motion on its shaft, C.

The claim of this patent is for—

The means herein described and shown for crushing and grinding metallic ores, consisting of the cylindrical pestle, *d*, provided with grooves in its upper part to crack the lumps of ore and set a shaft, C, on which it has a partial rotary motion, and operating in connection with the basin, A, in which said pestle moves to grind the ore into powder by the gradual approach of the sides of said basin to the cylindrical pestle, said pestle being also provided with a scraper or agitator, 5, in its lower surface to operate as specified.

The second patent is declared to—

Consist in providing means for keeping the pestle down with sufficient force to pulverize the material operated on, and also to prevent the pestle from grinding too finely, *i.e.*, to furnish material for simply cracking the ore or other material into small lumps of any desired size instead of grinding the same to a powder, thereby adapting the machine to different characters of metallic ores or other substances.

We have here no reflex or embodiment of either of the ideas that found expression in the Blake machine. The converging jaws, the revolving shaft, and the flywheel are all wanting, as in the Hobbs & Brown machine. Instead, there is a cylindrical nut or pestle, having a partial rotary and crushing motion communicated to it by means of a lever attached thereto. The pestle rotates on a central axis within an eccentric concave. The work is done by this pestle. There is nothing of the vibratory motion of a movable jaw, alternately advancing and receding, as in the Blake invention.

The difference is not that of mere mechanical equivalents. It is radical and goes to the essence of the organisms. These considerations are so obvious that further remarks upon the subject are unnecessary.

The proofs show that but two of the Hamilton machines were ever made. Practically the invention was abandoned.

This brings us to the question of infringement.

There are numerous points of similarity, and, indeed, of identity, in the respondent's machine, which are not controverted. It is for breaking stone. It has two upright jaws for this purpose, one fixed and the other movable. The jaws converge. The breaking is effected by the convergence. The movable jaw alternately approaches toward and recedes from the fixed one. This movement is produced by a short and powerful vibratory motion communicated by a revolving shaft with a flywheel upon it. There is an opening at the upper end of the jaws where the stones are received, and one below where they are discharged.

The only point of diversity insisted upon by the respondents is that the vibratory movement in the Blake machine is limited and unvarying, while in the machine of the appellants it is not of this invariable character.

In the Blake machine the movable jaw receives its movement from the revolving shaft through iron rods and levers. In the respondents' machine it is communicated from the revolving shaft through a confined column of water.

In the appellant's model the revolving shaft is not shown. In their machine it works the plunger of the pump from which the water is conveyed to a cylinder behind the movable jaw, whence it is applied to that jaw by means of a ram, the ram taking the place of the piston in an ordinary engine. Thus the vibrating arm, the toggle, the toggle joint, and the pitmen in the Blake machine are dispensed with, and their place supplied by the hydraulic arrangements we have described.

What is so employed in the appellant's machine is the obvious and exact equivalent of what is so dispensed with in the Blake machine. The liability of the packed joints to leakage is a serious objection to such use of water. Any considerable leakage would stop the machine. It could not be used while that condition existed. Constant care and vigilance are necessary in such cases to prevent the frequent occurrence of this evil. Water does not escape from a safety valve with the same celerity or effect as steam.

The Blake machine has a decided advantage in the greater simplicity and cheapness of its equivalents.

It is difficult to resist the conclusion that the change had no motive or purpose but evasion.

If there be no extraneous obstruction, the vibratory motion will be exactly the same in both cases. If there be such obstruction, the safety valve in the appellant's machine might possibly be brought into use with good effect. But if this were so, the valve would be only an addition and an improvement of the machine. The valve, therefore, is, in any view, quite immaterial to the inquiry we are pursuing.

Where an original machine and an improvement upon it are both patented, neither patentee can use what does not belong to him without the requisite authority from the owner. The appellants have embodied all the ideas of Blake's invention in their machine, the valve which supplemented it, whether good or bad, is outside of the case, and cannot effect the result.

We think the infringement is clearly made out.

It remains to consider the question of damages. A few remarks upon that subject will be sufficient.

The proof is meager and indefinite.

The infringers made but four machines.

No license fee charged by the complainant is shown. The burden of proof rests upon him. Damages must be proved; they are not to be presumed. The complainant made a profit of forty dollars an inch on the width of the jaws of the numerous machines he had sold.

But inventions covered by other patents were embraced in those machines. It was not shown how much of the profit was due to those other patents, nor how much of it was manufacturer's profit. The complainant was, therefore, entitled only to nominal damages. This the court gave him. It was all the state of the evidence warranted. It would have been error to give more.

The decree of the circuit court is affirmed.

The costs of each appeal are adjudged against the party taking such appeal.

United States Circuit Court—District of Massachusetts.

PATENT LAMP.—CHARLES E. ASHCROFT *vs.* WILLIAM HOLLINGS.

[In equity.—Before Shepley, J.—Decided April 13, 1877.]

The patent for a lamp, can, or barrel, packed in part with an absorbent or finely granulated material, and over them a body of wire gauze or perforated thin plate, either rolled up like paper scrolls or put flat together like book leaves, is not infringed by the use of a lamp containing cotton covered with a layer of asbestos or porous fireproof cement, and covered with one thickness of wire gauze.

The invention patented to Wm. Beschke, August 14, 1866, includes as a necessary ingredient wire gauze or perforated thin plate in the form of scrolls or of layers like the leaves of a book.

OPINION OF THE COURT.

Shepley, J.:

The defense in this case is based upon the alleged want of novelty in the invention described in the letters patent granted to William Beschke and others, August 14, 1866, No. 57,245, "for an improved method of using explosive fluids for the production of light and heat," and also upon a denial of any infringement of the Beschke patent. The question of infringement depends upon the construction to be given to the Beschke patent.

In view of the state of the art at the date of the patent, as well as upon what is clearly described in his specification and claimed in his claims, it appears to be clear that the invention of Beschke is described and claimed as consisting in a lamp, or can, or barrel, packed in part with an absorbent or finely granulated material (excluding sand and including sawdust, cotton, beads, shot, gravel, asbestos, and their equivalents), and over them "a body of wire gauze or perforated thin plate, either rolled up like paper scrolls or put flat together like book leaves."

The defendant sells a lamp for heating purposes, manufactured under letters pattent issued to Thomas W. Houchin, May 4, 1875, called Houchin's patent pocket cook stove. The lamp is made of metal, and is filled with cotton covered with a layer of asbestos, or of porous fireproof cement of which asbestos is an ingredient. The upper opening is covered with one thickness of wire gauze. There is no tube as distinguished from the body of the lamp, and there is no "body of wire gauze or perforated thin plate, either rolled up like paper scrolls or put flat together like book leaves."

Wherever in the Beschke patent wire gauze or perforated thin plate is alluded to, it is in the form of a scroll or of layers, like the leaves of a book, and after constantly repeating this description throughout the patent, and never using the words without some description of a scroll or layers, except in one instance, and then "wire gauze combined and shaped as mentioned," the patentee adds, "I disclaim also the simple use of mere wire gauze or perforated thin plate not rolled up like paper scrolls or put flat together like book leaves." The wire gauze or perforated thin plate, described in the claim of the Beschke patent, must be construed as referring to wire gauze or perforated thin plate rolled up like paper scrolls, or put flat together like book leaves, as described in the specification, and upon this construction of the claim in the patent the defendant does not infringe.

Bill dismissed with costs.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR AXLE BOX.

Edward L. Colman, Vandalia, Mo.—This relates to an improved car axle box, with anti-friction and self-oiling devices; and consists of the journal revolving in an elongated box, which is made of a top and bottom section, secured by bolted face and back plates. A number of friction rollers pass around the journal and around a guide channel below the same, taking up the oil by a bottom inlet from the outer box.

IMPROVED BRICK MACHINE.

Thomas McNicholas, Memphis, Mo., assignor to himself and Thompson Walker, of same place.—The moulds are similar to hand moulds, except that they have notches formed in their bottoms to receive springs attached to the bottoms of the channels in which said moulds slide, to hold them in place exactly beneath the discharge holes in the bottom of the mud box, and prevent them from being drawn back by the withdrawal of the pushers. The drive wheel causes pushers to bring the moulds beneath the discharge holes of the mud box, when the scrapers are in proper position to force out the clay, so that there may be no loss of time, and so that there may be no break in the passage of clay into said moulds to form imperfect or seamed brick.

IMPROVED LIFTING TONGS.

John T. Campbell, Rockville, Ind.—This is an improved device for lifting, carrying, dragging, or otherwise handling logs, timber, lumber, railroad ties, stone, etc., which is so constructed that it may be readily adjusted, as the character of the work to be done may require. It consists in a lifting tongs in which the handles are connected with the shanks of the jaws with an adjustable and reversible joint.

IMPROVED HAIR SPRING STUD FOR WATCHES.

Francis M. Martin, Cambridge, Ill., assignor to himself and John A. Hart, of same place.—This is an improved hair spring stud for the balance wheel of watches, by which the hair spring may be shortened or lengthened with great facility, and adjusted higher or lower, so as to be placed at a perfect level above the balance. The stud fastens to the hair spring without changing the same at the least at that point, so that it retains equal strength all around and moves in perfect isochronism. The invention consists of a stud, composed of a fixed and movable jaw, projecting downwardly, and clamped to the hair spring by a screw with tapering or eccentric head. The jaws are made to fit the curvature of the outer coil of the spring, so as to clamp the same without bending it out of its true shape.

IMPROVED CAR COUPLING.

Edward B. Middleton, Charleston, S. C.—When the cars are brought together, the projecting end of a hook enters the mouth of the opposite drawhead, strikes the beveled portion of a catch, raises the latter, together with its rod, and engages with the shoulder of a recess, thus completing the "lock" automatically. The parts are held so engaged so long as required by the gravity of the catch block.

IMPROVED RAILROAD TIE.

Alexander H. Campbell, Liberty, Ind.—This invention consists of a metallic cross tie of double T-shaped cross section, of which the bottom flange is cut out at the center. The tie is provided with sockets having bottom wedges for wooden filling blocks, retained by a central key driven down upon the wedge.

IMPROVED CUT-OFF OR VALVE FOR PUMPS.

Job Mansir, Richmond, Me.—This is a cut-off for the suction pipe of a pump, which is capable of making connection with either of two branch pipes, or both, as may be desired.

IMPROVED PIPE-CUTTING MACHINE.

Nehemiah Watson, Arcadia, R. I.—This invention consists, essentially, of a revolving circular saw, capable of cutting iron, and of a clamp for grasping the pipe and holding the machine in place during the forward feeding and cutting of the saw.

IMPROVED FLYING MACHINE.

Frank Barnett, Keokuk, Iowa.—This consists of a kite or horizontal sail provided with a boat or basket for passengers, which is placed on wheels, and is provided with propeller wheels for moving the apparatus, and with a device for guiding.

IMPROVED PITMAN CONNECTION.

Joseph Warren Blood, Minneapolis, Minn.—This is an improved pitman connection for that class of mowing and reaping machines that have a hinged finger bar and tilting device. It is so constructed as to admit of the different movements which occur while in operation without binding.

IMPROVED CIRCULATING DEVICE FOR STEAM BOILER.

Henry S. Coleman, Chelmsford, Eng.—This consists in the employment in a boiler of circulating tubes suspended within the tubes connecting the two shells of the boiler. The said circulating tubes are straight vertical tubes of about half the sectional area of the outer tubes, and extend upward a short distance into the upper shell, and downward to the bottom. They are so supported as to be readily removable out of the way for cleaning the boiler, and for this purpose a rotating shaft is mounted, to which in the upper shell all the tubes are connected, so that they may be raised simultaneously. The tubes are also constructed in two parts, one sliding within the other.

IMPROVED WINDMILL.

William Ap Williams, Cambria, Wis.—The object here is to diminish the friction in the working parts of the mill, and thus enable it to be run with a lighter wind than would otherwise be possible. The construction is such that the leverage is the same when lowering and when raising the pump rod.

IMPROVED BARK MILL.

William F. Mosser, Allentown, Pa.—This is an improved mill for grinding bark, provided with a safety device to prevent breakage should a foreign substance get into it. The breaker serves as a coupling, and is of such strength as to drive the runner under ordinary circumstances; but should any hard substance get into the mill, the collar will break and thus prevent the mill from being injured.

IMPROVED TURBINE WATER WHEEL.

Nathan H. Gould, Oakfield Centre, Mich.—This is an improvement in the class of water wheels having guides for directing the water against the buckets. The desk or surface of the throat plate is flat and smooth, so that little impediment is offered to the free passage of the water through the outlet holes, and the guides are so constructed as to aid materially in directing the water at right angles against the buckets of the wheel.

IMPROVED BOOT AND SHOE SOLE TRIMMING MACHINE.

William E. Forster and Willard C. Tolles, Nashua, N. H.—This consists of a revolving cutter in combination with a feed table and adjustable gauge. The cutting knife is keyed to the shaft in such a manner as to be readily taken off for sharpening, and projects about the thickness of the sole or heel above the table on which the boot or shoe rests. The table is provided at the front part with a straight or concave throat plate, on which the sole or heel of the shoe rests when being exposed to the action of the knife. The shoe is run along the gauge, which bears against the upper of the shoe, the heel or sole being turned on the throat plate and trimmed off by the cutter.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED ICE CREAM FREEZER.

John Salter, Baltimore, Md.—This invention relates to an improvement upon that form of ice cream freezer having a stationary scraper in a revolving cylinder, which scraper is held stationary by its connection with a top plate, while the cylinder is revolved through a horizontal shaft with a bevel wheel that engages with corresponding beveled teeth on the top or cover of the cylinder. The improvement consists mainly in making the horizontal drive shaft hinged or jointed, and fixing its outer extremity in an outside independent bearing, so that the inner portion of the shaft with its bevel wheel and the top plate of the freezer may be together lifted off the tub and supported away from the same whenever it is desired to remove the cylinder or inspect its contents.

IMPROVED FILTERING APPARATUS.

James Gainey, Augusta, Ga.—It consists of an adjustable plunger, to effect the compression of the filtering material in adapting the device to filter under varying degrees of pressures, in combination with the means for passing the water through the filtering chamber in the opposite direction to cleanse the filter without reversing the position of the same. It also further consists in locating an expansible spring directly in the filtering material, so that when the pressure of the plunger is relieved the movement of the spring in expanding loosens up the filtering material to adapt it to be thoroughly cleansed by the passage of the water through it. The apparatus is designed to be used in both double and single form, and is adapted to all kinds of filtration, but more especially to the filtering of water for household purposes.

IMPROVED LADLE FOR METAL FOUNDING.

William Fawcett, Omaha, Neb.—In the manufacture of car wheels, iron of high specific gravity has to be used in order to procure the necessary depth of chill. In wheel foundries a large ladle holding from five to ten tons of molten metal is placed in front of cupola and allowed to run full before pouring off. During the time of melting and casting, the hard, dense, and close metal will settle to the bottom by its own gravity, while all impure and light metal will rise to the surface. The wheel cast with metal from the top cannot have the proper chill, while those cast from the bottom iron are so hard and brittle as to be unsafe to be placed under a passenger car. By drawing the metal first from or near the bottom, a uniform chill is procured all through the heat, and to this end the invention consists in constructing the ladle with a vertical conduit in the side thereof which opens into the bottom of the ladle, so that as the latter is tilted the purer and denser metal at the bottom of the ladle passes up said conduit and discharges first into the mould, leaving behind the lighter metal and the scoria floating in the top of the ladle.

IMPROVED SAFETY POCKET.

Frederick Wendt, Utica, N. Y.—This consists of a pocket having a small interior pocket of the inner top part, in connection with a top flap, fitting into the small pocket, so as to close or open the main pocket.

IMPROVED ROWLOCK.

William Spelman, Portland, Me.—This oarlock is so constructed as to diminish the friction between the oar and lock. It is made square, with its corners cut off, and there is an opening in its rear upper corner for the blade of the oar to be passed through. It is journaled to a block which is suitably pivoted to the gunwale.

IMPROVED HOP DRYER.

Samuel R. Templeton, John C. Templeton, and Joseph H. Templeton, Brownsville, Oregon.—This is an improvement in the class of drying apparatus in which a furnace and fan blower are combined, the one to impart heat and the other to impel the heated air through or in contact with the substance to be dried. The hops to be dried are placed upon a cloth, laid upon racks in layers of any desired thickness, so that the hot air may be forced up through them, expelling the moisture and drying the hops quickly.

IMPROVED REAR SIGHT FOR FIREARMS.

Charles F. Robbins, Brooklyn, N. Y.—This is a gauge for adjusting the rear sights of rifles from a zero point to the maximum of windage, at either right or left hand.

IMPROVED VERMIN TRAP.

Jean M. A. Berger, Charleston, S. C.—This consists of a frame or base of willowware, provided with boards having proper interstices attached to cross strips in close proximity to the willow frame. The trap is placed in position either at the head or foot end of the bed, or between the mattress and slats, or between bedstead and bedding, or at any other place where the insects are apt to congregate. The bugs, roaches, or other vermin are attracted by the large number of recesses and cavities of the trap, and are fond of hiding in the same.

IMPROVED CIGAR CUTTER.

H. Friedrich Schultze, Philadelphia, Pa.—This is an improved device for cutting off the points of cigars by the use of one hand only, the tips being dropped into a storage receptacle. It consists of a storage receptacle having a swinging and guided lid, with gauge holes for the points of the cigars, and resting on a spring cutting-knife, that passes below the gauge holes and cuts off the points by pressure on the lid.

IMPROVED FOUNTAIN PEN.

Henry N. Hamilton, White Plains, N. Y.—This fountain pen is so constructed that it may receive and hold enough ink to write one or more pages of manuscript. It also may be adjusted to let down the ink more or less freely, and it may be carried in the pocket, if desired.

IMPROVED ENGRAVING MACHINE TABLE.

Augustus E. Ellinwood, Garrettsville, O.—This is a table for holding the patterns or forms used in engraving machines by means of an elastic lip, secured in a groove in the table, which receives one of the edges of the pattern, and a longitudinal slot that receives a lip formed on the other edge of the pattern.

IMPROVED SHOTBAG AND CHARGER.

Thomas J. Jolly, Etna, Mo.—By this shotbag and charger any given quantity of shot may be uniformly and quickly taken out from the bag for the purpose of loading shotguns. The bag has a perforated bottom and a sliding pivoted plate, with a downward extending tube, having a bottom flange, interior charger, and plug fitting into the bottom hole to close the same and lift the charger.

IMPROVED BOOT OR SHOE.

Thomas J. Greenwood, Warren, Ill., assignor to himself and Thomas D. Thornton, of same place.—This is an improved seamless-back shoe. It has a quarter, which is cut of one piece of leather, along a center line and symmetrical curved side lines, and with holes near the highest point of the instep, to produce front sections and back tongue. The front sections are spread or sprung forward, and a top quarter of corresponding shape is placed between the same and stitched to the edge of the quarter. In this manner a shoe with seamless back is produced that may be made with any style of top quarter or vamp.

NEW TEXTILE INVENTION.

IMPROVED STOP MOTION FOR LOOMS.

Fred. Christen, Homestead, Iowa.—The object of this invention is to provide a simple and effective weft stopping device for fancy looms using two or more colors of thread. It consists in a novel arrangement of fingers, between which the filling passes as it runs out of the shuttle, one series of which, on the breaking of the filling threads, moves so as to actuate a stopping device. The improvement is designed for that class of looms that weaves fabrics from threads of several colors, which are introduced into the warp in succession; and it is intended for stopping the loom or the pattern-forming mechanism of the same.

NEW AGRICULTURAL INVENTIONS.

IMPROVED STUBBLE GUARD FOR PLOWS.

Benjamin F. Phillips, Lowden, Iowa, assignor to Nicodemus Henry, of same place.—This is an improved device for clearing a plow of stubble, weeds, and other trash. By it the plow can be cleared by the plowman while standing erect in his place, and without stopping the team. It is a pivoted bar, attached to the beam, having pronged ends which rest on the mouldboard. It is operated by a suitable lever.

IMPROVED CULTIVATOR.

John Rhodes Tilley, Demerara, British Guiana, South America.—The new features include means to enable the plows to be raised from and lowered to the ground, and adjusted to work at any desired depth in the ground. Also devices whereby the cutting knives are given a slow rearward motion beside that caused by the forward progress of the machine.

IMPROVED STRAW CUTTER.

Eric M. Hesselbom, Riceford, Minn.—This machine for cutting straw and hay for feed for stock is so constructed that the straw or hay will not be fed forward when the knives are cutting. It may be readily adjusted to cut the feed coarse or fine.

IMPROVED SULKY PLOW.

Albert A. Fowler, Plano, Tex.—This invention relates to the construction and arrangement of parts whereby the tongue and connected devices may be adjusted laterally according to the number of plows employed at one time, or according to their respective positions when used; also, whereby the plow beams are held rigidly parallel, although adapted for adjustment laterally and allowed free vertical movement.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED METHOD OF FORMING BLANKS FOR BOOTJACKS.

Henry A. Brown, Toledo, O.—This consists of taking a continuous strip of wood of suitable length, and of the width and thickness of the main piece of the common bootjack, and cutting the same alternately at suitable oblique angles, so as to produce separate pieces with tapering ends and a thicker intermediate point or seat for the cleat. The tapering ends of the bootjack allow the more convenient packing for shipment.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Spy Glasses and Telescopes of all kinds and prices. Lenses for making the same, with full directions for mounting. Illustrated priced circular free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

Reliable Oak Leather and Rubber Belting. A specialty of Belting for high speed and hard work. Charles W. Arny, Manufacturer, Phila., Pa. Send for price lists.

How to make Violins—Write J. Ranger, Syracuse, N.Y.

Shaw's Noise-Quieting Nozzles, for Escape Pipes of Locomotives, Steamboats, etc. Quiets all the noise of high pressure escaping steam without any detriment whatever. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M.E., Providence, R. I.

For 13, 15, 16, and 18 in. Swing Screw-Cutting Engine Lathes, address Star Tool Company, Providence, R. I.

For Sale.—Second-hand 4 Sided-Moulder, with about 300 knives; good as new; price $500. T. R. Bailey, Agt., Lockport, N. Y.

Will A. T. S., who advertised June 9 for a Manufacturing business, address Box 1021, Providence, R. I.

Wanted—A partner with about $7,500 in a Manufacturing concern; no competition; will pay 25 to 30 per cent. on investment. Address E. Y. M., Pittsburgh, Pa.

Combined Miller and Gear-Cutter; capacity large; almost new; a bargain. C. A. Conde & Co., Phila., Pa.

For Boult's Paneling, Moulding, and Dovetailing Machine, and other wood working machinery, address B.C. Machinery Co., Battle Creek, Mich.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufont & Co.'s Batting Cloth. Send for large illustrated catalogue.

Steel and Iron Set Screws, manufactured by L. F. Standish & Son, New Haven, Conn.

Electric Gas Lighting Apparatus, applied to public and private buildings. The latest improvements. A. L. Bogart's patent. Address 702 Broadway, N. Y.

Patent Taper Sleeve Fastening and Wooden Pulley Works are now in full operation. Orders solicited. Satisfaction guaranteed. A. H. Gray, Erie, Pa.

Painters, etc., get circular, prices, etc., of New Metallic "Wiping out" Graining Tools; 75,000 now in use. J. J. Callow, Cleveland, O.

Removal.—Fitch & Meserole, Manufacturers of Electrical Apparatus, and Bradley's Patent Naked Wire Helices, have removed to 40 Cortlandt St., N. Y. Experimental work.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocum & Son, Drinker st., below 147 North Second st., Philadelphia, Pa.

Small Fine Gray Iron Castings a specialty. Warranted soft and true to patterns. A. Winterburn, 16 and 18 De Witt St., Albany, N. Y.

Articles in Light Metal Work, Fine Castings in Brass, Malleable Iron, &c., Japanning, Tinning, Galvanizing. Welles' Specialty Works, Chicago, Ill.

Book Binders' Case Binding Machine. Send for illustrated circular. Frank Thomas & Co., Cincinnati, Ohio.

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Yacht and Stationary Engines, 2 to 20 H. P. The best for the price. N. W. Twiss, New Haven, Conn.

All nervous, exhausting, and painful diseases speedily yield to the curative influences of Pulvermacher's Electric Belts and Bands. They are safe and effective. Book, with full particulars, mailed free. Address Pulvermacher Galvanic Co., 302 Vine St., Cincinnati, Ohio.

To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N.Y.

Territory, on a Useful Household Article, given away free. Address Ezra F. Landis, Lancaster, Pa.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 398.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

Emery Grinders, Emery Wheels, Best and Cheapest, Hardened surfaces planed or turned to order. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

Notes & Queries

C. N. will find a table of the prices of metals on p. 169, vol. 33. As to powerful explosives, see p. 2, vol. 34. As to the most deadly poison, see p. 155, vol. 31.—A. K. will find something on the properties of selenium on p. 241, vol. 30.—C. C. C. is informed that the *Textile Manufacturer* is published in Manchester, England.—G. H. W.'s query was answered under the initials G. H. M., p. 368, vol. 36.—A. A. can calculate the horse power of his engine by the formula given on p. 33, vol. 33.—F. E. M. will find something on removing moles or freckles from the face on p. 374, vol. 32.—J. A. McN. will find an explanation of the apparent variation in the size of the moon's disk on p. 305, vol. 34.—B. L. D. should use crude or pure rubber in the preparation of marine glue.—C. W. I. will find directions for removing mildew from cloth on p. 250, vol. 34.—R. should consult his family physician.—D. S. R. will find on p. 20, vol. 30, directions for deodorizing cod liver oil.—W. C. R.'s query as to gas cylinders for calcium light is answered on p. 380, vol. 36.—S. A. M. will find that the claims of the Keely motor people are fully exposed on p. 400, vol. 32.—P. W.'s query as to weight near the surface of and in the depths of the ocean is answered on p. 363, vol. 36.—J. C. B. will find good tables of logarithms in Culley's "Handbook of Telegraphy."—J. L. C. will find directions for building an aquarium on p. 90, vol. 30.—G. C. will find directions for tempering small drills on p. 85, vol. 33.—T. J. S. S. will find a formula for the width of belts on p. 58, vol. 27.—J. G. K. will find the address of the inventor of the calculating machine in the article describing it.—E. L. L. F. will find an article on watermelon sugar on p. 191, vol. 25.—C. P. will find full particulars as to the Great Eastern steamship on p. 346, vol. 31.—S. A. E. will find something on utilizing mica on p. 241, vol. 34.

(1) J. says: You recently informed a correspondent that you knew of no better way of pouring a Babbitt metal box, where the box is solid instead of being in halves, than by wrapping paper around the shaft to allow for shrinkage of the Babbitt metal. This slovenly plan has two objections. The paper is too thick to make the proper fit, and the metal shrinks on the paper and makes the box difficult to remove after pouring. Neat workmen warm the shaft and coat it with soap. But I have seen workmen make use of a plan so simple, so perfect, and so novel that I think it worthy the name of a wrinkle. It is simply to place the box horizontally, pour it half full, and let it cool. Then pour the other half. The result is a solid box in halves. The metal will be found to fill the casting solidly and not to have shrunk on the shaft.

(2) J. O. C. says: I have a wood lathe, bed made of 4½x14 inches oak timber, head and tail stock of wood, with a cast steel head spindle with 1¼ inches bearing, 4 inches long. In turning wagon hubs, the lathe runs smoothly and without jar. Please let me know if I can turn iron on the lathe by using a hand slide rest? A. Yes.

(3) G. H. asks: What particular bones of the whale supplies us with the article of commerce known as whalebone? A. Whalebone is not, as its name might seem to signify, obtained from the bones of the whale, but from a substance which forms a substitute for teeth in the Greenland and other whales. This substance consists of flat plates or blades, hanging from the sides of the upper jaw (occupying the position of teeth in other animals). They are usually about 300 in number on each side, and are arranged parallel with each other, at right angles to the jaw. They are usually, at the middle of the jaw, about 9 feet in length. A full sized Greenland whale yields about 1 ton of these.

(4) W. E. G. asks: At what part of the crank stroke of an engine should the slide valve open the ports? A. The port should be about ⅛ inch open when the crank is on the dead center.

(5) G. W. S. says: I am about completing an invention that requires the use of a small cord, not to exceed 1½ inches in circumference. I would prefer that it should be 1½ inches in circumference, and desire it to sustain strains of at least 400 lbs. I do not think wire can be made to answer, and wish to know what is the best material in a rope or cord of the two dimensions? What are the breaking and safe strains of such cords? A. Good hemp rope, of either size mentioned, can be made of the requisite strength. Silk cord can be made much smaller. You should apply to manufacturers for prices.

(6) H. B. says: I am engaged in file cutting and have considerable trouble from the files cracking in tempering. In 170 gallons of water used for tempering, I use the following ingredients: ⅛ pint oil of vitriol, ⅛ lb. alum, ¼ lb. borax, ¼ lb. prussiate of potash, and have the water salted so that a potato will float on it. What additional ingredients must be used, or what can be done to prevent the files cracking? A. Your files are probably heated too high. Try heating lower, and dip vertically.

(7) F. S. says: We have a four horse power caloric engine, which we would like to run with oil. We now run it with anthracite coal, which costs us $10 per ton, and the air passing through the fire deposits so much grit in the cylinder as to cut out the packing ring and the cylinder in a short time. Which would be the cheapest, coal or oil? And if the latter, which would be the best kind of oil? A. We advise you to confer with the manufacturers.

We have a cistern built in clay ground; after having finished it, we found that water had made its way in. Thinking that it was not cemented enough, we put on 6 or 7 coats; but water still comes through. What can be done with it? A. We could not tell without knowing more particulars. If there is a spring in the neighborhood, it may be necessary to give it another outlet.

We have an iron roof on our factory which sweats in frosty weather, the sweat dripping down on the machinery. What can we put on to prevent it? A. You should either ventilate and heat the building more effectually, or cover the iron with some non-conducting material.

(8) C. H. M. says: I have a 12x14 inches engine. The steam follows the valve 10 inches. I am about putting in new valves, and am thinking of using more lap so as to make the valve cut-off earlier. Of course the exhaust will open the same, but will close earlier, unless I make it open very early. I want to know whether there will be any gain in so doing? A. You will gain by giving your valve sufficient lap to cut off the steam at about ¾ stroke.

(9) T. R. W. asks: What is the best disinfectant for kitchen drains, cesspools, etc.? A. Use chloride of lime (hypochlorite of calcium), or carbolic acid.

(10) E. M. L. asks: How can I utilize small scraps of tortoiseshell? A. Small pieces of good tortoiseshell may be joined so as to form one large apparently seamless piece in the following manner: Slope off the margins of the shells for a distance of about a quarter of an inch from the edge. Then place them so that the margins overlap one another; and thus arranged put them in an iron press and immerse in boiling water for some time. The pieces by this means become so perfectly united that the joint cannot be seen. The filings and very small scraps may be softened in hot water and consolidated by hydraulic pressure in metal moulds. Protracted heating of tortoiseshell darkens it, and greatly lessens its beauty.

(11) J. H. B., of Leeds, England, says: I require a peculiar kind of cement. I have used plaster of Paris and white lead, which, when moulded and hot pressed, forms into a very hard substance: but it rubs off on to fabrics when being pressed on to them in a chamber containing steam. Can you suggest anything that will keep the white from rubbing off? A. You might try a wash of strong alum solution. Perhaps a better cement for the purpose would be that made with lime and albumen. Slake freshly burnt lime with boiling water; this occasions it to fall to a very fine dry powder, if excess of water has not been added. White of egg or blood albumen should be intimately mixed by beating with an equal quantity of water; and enough of the lime powder should be added to form a thin paste, which should be used speedily, as it soon sets. This is a valuable cement, possessed of great strength, and capable of withstanding steam or boiling water.

(12) M. A. says: We have a lot of plated spoons that are discolored with a bluish purple cast resembling that on tempered steel. We fear to injure the polish. Can you tell us how to clean or remove the color without injuring the polish? A. The discoloration is very probably due to the formation of a film of sulphide of silver. This may be removed by dipping for a moment in strong nitric acid, and then washing immediately in running water. If the silver is permitted to remain in contact with the acid for more than a moment or two, the polished surface will be injured, so that it is preferable to rub off the film with a little finest tripoli powder and a piece of chamois skin or a soft brush.

(13) C. W. G. asks: How do you account for the fact that some of the genuine fifty and twenty-five cent pieces have not the ring of true metal? I sometimes see coins that, when thrown upon a counter, sound like lead; and yet they stand all the other tests, and are to all appearances genuine silver coin. A. It may be attributed to some flaw, crack, or strain due to distortion. Most of the non-sonorous coins in circulation are not genuine.

(14) P. M. B. asks: How can I remove an oil stain from granite, caused by having left some fresh oiled putty on the same? A. Moisten the spot with bisulphide of carbon, and immediately cover it with dry pipeclay or kaolin.

(15) E. P. H. says: I have a bronze mirror, and it has become dull and a little defaced by handling. I cannot find anything that will restore the polish. Can you tell me what to do with it? A. Rub it over with a cloth moistened with dilute sulphuric acid; wash with water, dry, and polish, first with finest tripoli, and then with putty powder on a piece of chamois skin.

(16) A. C. A. asks: How can flowers be wrapped up so that they can be sent by mail without wilting? What is the best way to send roots and plants by mail? A. Dip them for a moment in dilute glycerin and pack loosely in cotton (moist) in small pasteboard boxes. Roots or bulbs should be wrapped as tightly as possible in a strip of cloth moistened with a mixture of about 1 part glycerin to 3 parts water, and packed in small pasteboard boxes.

(17) C. H. says: Can you give full particulars of the preparation of powder paper? Would it explode under pressure, without ignition? A. It is very probable that it would. We have not tried the experiment.

(18) T. H. L. asks: Do all animals above fishes perspire through the entire surface of their bodies? A. To a greater or less extent, this is, we believe, the case with all of the higher animals.

(19) R. S. H. asks: What will take the stain of apple juice out of white cambric muslin? A. Rub the spots well with strong alcohol, and then moisten with a little very dilute sulphuric acid (1 part acid to 20 parts water), and cover with moist bleaching powder (chloride of lime) until the spots disappear. Finally, wash well with soap and water.

(20) W. H. J. says: I have a parchment diploma that has hung against a brick wall till it has become wrinkled from gathering moisture. How can I make it smooth again? A. Cover it on both sides with bibulous thin blotting paper, and pass a warm iron over the reverse side until it is properly smoothed.

(21) M. B. H. says: I am sprinkling the streets with a 300 barrel tank, from which I fill my wagon, which holds 19 barrels water. Can you tell me how much chloride of calcium would be necessary to keep the dust down, going over the ground two or three times a day? Would it be better to put the chloride into the large tank or the small one? A. We think the smallest quantity to be used is about 1 lb. to the barrel (=⅛ oz. to 1 gallon). If you can make sure of its complete solution, you had better add it in the small tank.

(22) C. T. L. says: In making fly paper, I wish to put a preparation of sticky materials on calendered writing paper. On one side, I put an extra sizing of glue; but I cannot spread it evenly, and it stains through the paper. A. Use a sizing of a thin solution of shellac in borax, or dip the paper for a moment into a solution of beeswax in methylic alcohol, and then pass it between hot rollers. The sheets may then be glue-sized by laying each sheet, face downward, on the surface of the bath.

(23) H. M. H. asks. What are the chemical changes produced on the photographic plate from the time the collodion is flowed on to the time the fixing solution is washed off? And what are the lights and shades composed of before and after the plate is fixed? A. Upon putting the collodionized plate into the silver bath, the iodides or bromides contained in the collodion cause a precipitation of insoluble iodide or bromide of silver on the collodion. On exposing this to light, a partial reduction of these salts ensues wherever the light strikes it—the stronger the light the greater the reduction—and this reduction is in so far completed by the action of the developer that the parts exposed to light become insoluble in the fixing solution (hyposulphite of soda or cyanide of potassium). Before fixing, the shades are composed of basic salts and oxide of silver, the lights of unreduced salts. In the fixing bath all of the unreduced salts are dissolved out, while the rest remains unchanged. The lights in the finished negative are therefore the transparent portions.

(24) F. P. asks: How can an aqueous solution of Liebig's extract of beef be prepared? A. Dissolve 1 part extract in about 30 parts warm water.

(25) H. L. C. says: I wish to make some permanent U magnets of cast steel, of ⅝ x 1 inch bar. They are to be 7 inches long, and capable of supporting 8 or 10 lbs. Can I charge them by using an 18 by 1 inch round iron formed into a U shape, and wound with 75 feet of No. 14 cotton-covered wire, with battery power consisting of two Hill cells? A. Yes, but one Grove or carbon cell would answer better.

(26) B. says: I have a cistern which is made in clay ground; and it lets in water through the cement, and makes the rain water hard. It has 6 or 7 coats of cement, and still the water comes through. What is the reason, and how can I prevent it? A. No kind of cement that is mixed with water can be depended upon absolutely to make a lining impervious to water. You require an asphaltic cement put on in several coats, and fortified and loaded down with a brick or concrete bottom and sides, to keep it in place, so as to resist the pressure of the exterior water when the cistern is not filled.

(27) F. D. H. asks: In connecting the coils of an electromagnet, which are the proper ends of the wire to join, those nearest the cores or the outside ones? A. It is usual to join those nearest the core.

(28) J. C. W. asks: How can I build a hot-house of lumber, for flowers in the winter? A. Locate it so as to harmonize with surrounding buildings, but place it so as to front either south, southeast, or east. Let the front wall be 2 feet above the ground, and the rear wall sufficiently high to give the glass roof a slant of 45°—the height depending upon the width of the building. If the soil is dry, the floor may be sunk 2 feet below the surface of the ground by excavating to that depth. If you have stone, build foundation walls 18 inches thick up to 6 inches above surface of ground, lay sills around and set your posts about 4 feet apart, their size being 4 by 4 inches. Cover the front and rear, both on the exterior and interior, with tongued and grooved boards, and pack the 4 inch space between the boarding with dry sawdust or wood shavings rammed close. If you have no stone, use locust or chestnut posts, driven well into the ground and sawed off level for the sill. Make your rafters of sufficient size to suit the width of the building, and placed so as to properly receive your glass frames, and provide in the 2 feet wall at bottom, and in the upper row of sashes, a ventilating shutter to every other opening between the rafters. Put the door in the warmest end, and construct the ends of glass. To provide against severe weather, procure a hot water greenhouse stove and pipes, and set the same according to the directions given.

(29) J. W. S. says: A house that cost $15,000 caught fire from a chimney; the gas had eaten the mortar away from the bricks. Is there anything that can be put in mortar that will counteract the effects of the gas? A. Make your mortar of lime and clean sharp sand (no clay or loam); make the walls of the flues fully 4 inches thick, and fill the joints of the brickwork with the mortar properly, and there will be no danger of the gas eating through the mortar to set the house on fire.

(30) J. J. says: A large reservoir 20 feet deep, 2 miles from town and 200 feet above town, has two pipes equal in size and length. One is inserted at bottom of lake or reservoir, the other near the top; and both are led to the same point in town. Which would supply water first or run the most? What would be the difference if the top pipe were connected to a small box three feet square which is kept supplied with water at the same height as the reservoir? A. The head of water, or the pressure at the bottom of the pipe in town, is the same in both cases, the only difference being in the length of time that the supply would continue—the pipe which connects near the top of the tank ceasing to flow when the water subsides to that point, but the other continuing until the tank is fully discharged.

(31) B. & C. F. say: 1. We propose building a storehouse. We desire to know which is best, brick or stone, stone being white sandstone of good quality and the brick medium? A. The brick wall could be laid up in less time than stone and would answer of less thickness—it would therefore most likely be more economical; it would also stand fire better. 2. Which is best for roofs, tin or sheet iron? Should it be painted? A. A roof of bright I C plate charcoal tin is the best; and it should be painted 2 coats of best yellow ocher paint.

(32) A. G. says: I got some small articles for silver plating, and tried your recipe given on p. 209, vol. 31, but without success. The articles are of a composition of tin, zinc, and lead or antimony, 1 to 2 inches long and ½ inch wide. How can I succeed? A. Probably you were not careful enough in cleaning the objects. Try boiling and rubbing them in a solution of caustic soda, made by boiling about 2 lbs. of common

soda crystals with milk of lime, produced by slacking ½ lb. of quicklime with hot water well stirred: then rinse them in a fresh caustic soda or potash solution and transfer immediately to the silver bath.

(33) V. & G. say: 1. We cut off steam at 8 inches on one end and 10 inches on the other end of our 14x28 inches cylinder. Is this right? We find that if we make it cut off alike on both ends that the valve opens wider on one part than the other. A. It is impossible in a common slide valve to make the points of admission cut off and release equal for each stroke; and it is preferred to keep the points of admission equal. 2. There is about ¾ of an inch space between the cylinder head and the follower. Would we save any steam to make our cylinder head thicker and reduce this space? And if so, how much space should there be? A. Yes. About ½ inch. 3. Is a variable cut-off valve, working on the back of the main valve, better than to vary the cut-off of the main valve by raising or lowering one end of the eccentric rod on an arm? A. It is considered so.

(34) L. H. R. asks: 1. In electricity, what is an ohm, and why is it so called? A. The ohm is the unit of resistance in electrical measurements. It is equal to the resistance of a prism of pure mercury, one square millimeter in section, and 1·0486 meters long, at 0° C. The name ohm was given the unit in honor of Dr. Ohm, a celebrated physicist. 2. In chemistry, which of the two metals, zinc and lead, has the greater affinity for silver? A. Zinc.

(35) A. H. R. says: I wish to make a pair of waterproof pants, in which to work in water from 6 to 10 hours at a time, without getting wet through. Will twilled cotton, thoroughly coated with raw oil, answer the purpose? Or is there any better coating? A. No. Try a mixture of about 10 parts boiled oil and 1 part beeswax, thinned down so as to readily penetrate the cloth. A better way is to use a thin varnish made by dissolving india rubber in bisulphide of carbon containing about five or six per cent of absolute alcohol. A very thin coat of the varnish will answer, and is cheap.

(36) J. K. T. asks: Is there any way to shrink boots, which have been stretched while wet, into shape again? A. We do not know of any.

How can I polish a gun stock? A. Put on several good coats of shellac, rubbing each one down when dry with pumicestone, and finish with a fine linen wad kept constantly moistened with thin alcoholic shellac and occasionally a drop of oil.

(37) B. L. H. asks: Will you please inform me of the process of marbleizing iron? A. See article on enameling iron ware, p. 21, vol. 35. The variegated colors may be produced by the addition of oxide of antimony, manganese, and iron to the glazing, before the final fusion. This also answers W. M.

(38) A. R. S. asks: How can I get the impression of an article in plaster of Paris without the article becoming set in the plaster? A. If there are any inward curves or angles in the model you cannot make a correct cast of it at once. For intricate work the model must be in several parts, from each of which a separate cast is taken; and then all of them properly joined to form one mould. This subject has been dealt with in detail by Mr. Joshua Rose in late numbers of the SCIENTIFIC AMERICAN. Where the undercut curves or angles are not very sharp, it is sometimes possible to get a cast in glue, which, being more elastic than plaster, admits of a certain amount of compression and stretching in removing the pattern. The water in which the glue is dissolved is mixed with enough glycerin to retain the glue as a stiff jelly on cooling. The patterns are carefully oiled before being brought into contact with the glue. From the first cast a second one, in glue, may be taken, and from this, in turn, a plaster cast, thus copying the first.

(39) T. W. asks: What is the best non-conducting material (for heat) whether of animal, vegetable, or mineral nature? A. Among substances of animal origin, feathers, wool, hair, silk, etc., are the best. Among vegetable substances, charcoal, sawdust, shavings, cotton, and dry fibers in general. All these, when dry, are excellent non-conductors. Of mineral substances, asbestos, mineral wool, porous tiles, and clay bricks, also slabs or bricks of porous infusorial earth, etc.

(40) N. M. W. asks: How can I clarify and polish horn? A. It is usually first scraped, and then rubbed down with emery powder and water, and finished with tripoli or rouge. In working horn, the bony core should first be removed by soaking in cold water for several weeks, which treatment loosens the core, so that it may be pulled out. Boiling water temporarily softens horn; and while soft it may be slit, and spread out by pressure between hot iron plates.

(41) A. L. B. says: In one of your papers I see a statement of the effect of sulpho-carbonate of potassium on the eggs of the potato bug. Would the application of this chemical to the field be likely to poison the potatoes, so as to make their use dangerous? A. No; but it may impart an unpleasant smell to some of the tubers, if used excessively.

(42) Z. H. asks. 1. Can grain nickel be melted in an ordinary furnace used for melting brass? A. If the furnace is provided with a very good draught, you may succeed in fusing small quantities of it at a time. It requires a very high temperature, and a long exposure in the furnace to get it liquid enough to run. 2. Will it run without an alloy? A. Yes.

(43) A. L. S., Queensland.—Remit 16 shillings sterling for SCIENTIFIC AMERICAN one year, which includes postage.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

J. M. B.—A. is properly an agate, of little value. B. are pebbles of milky quartz and flint.—W. J.—It is a clay containing a considerable amount of infusorial silica. It is an excellent article for polishing purposes, and, if properly washed, might prove marketable.—J. H. C.—No. 1 is an indurated clay, containing much oxide of iron. No. 2 is a piece of red jasper. No. 3 is a felspathic rock, containing small specks of iron pyrites and chalcopyrite (sulphide of copper). No. 4 is nodular pyrites (marcasite). See p. 7, vol. 36. None of the specimens are valuable.—H. W. S.—It is mostly magnetic pyrites (pyrrhotine).—M. S.—No. 1. The coating contains manganese and very probably zinc. No. 2 is an earthy oxide of cobalt—a variety of No. 1. No. 3 is gneiss rock with sulphide of iron. No. 4 is magnetite. —F. H. P.—A is a piece of hornblende. B is gneiss rock, with a few iron garnets. The crystal is calcite—carbonate of lime.—M. W. R.—It is mica schist (a silicate of potash, alumina, magnesia, and iron) with chlorite (a hydrous silicate of magnesia, iron, and alumina). —K. H. R.—They are pebbles of flint, common agate, chalcedony, and quartz. We do not consider them valuable. Such pebbles can be found on most sea shores. It is impossible for us to say where the pebbles came from, or where similar ones could be found in quantities. We have seen magnificent agates from the Pacific coast, and we understand that they abound near San Diego, Cal.—E. E. E.—It is not coal, but clay containing a large amount of carbon.—C. A. M.—It is a wax, called by dealers Carnauba wax.

M. B. & R., of Melbourne, Australia, say: The greatest enemy that the fruit gardener has to contend with in this colony is the sparrow, and it seems a matter of great wonder that no means have yet been introduced to stop its ravages. Those who have not had ocular demonstration would scarcely credit that these little creatures could commit such havoc. Settling in flocks upon the choicest fruit trees, they will quickly completely denude them of every particle of ripe fruit. Here is an opportunity for the ingenious American to distinguish himself by inventing some contrivance to preserve the trees from their ravages. Of course the invention must also have the merit of cheapness, so as to bring it within the reach of all classes.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Painting Axes. By W. E. W.

On the Dunkirk Microscopical Society. By C. P. A., and by J. E. S.

On the American Cicada. By H. H.

On a Discovery in Geometry. By L. S. B.

On Torpedoes. By J. P. W.

On Converting Motion. By F. S.

On a Decimal System of Computing Time. By C. E. D.

On Capital and Labor. By ——.

On Boiler-Covering Composition. By P. C.

On Liquors. By C. F. F.

On Water Evaporated through Engines. By W. A. M.

Also inquiries and answers from the following:

C. M. K.—S. B. E.—A.—J. B. B.—A. S.—J. M. W.—A. S. T.—J. E. B.—B. K. A.—W. O. W.—J. C. H.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes machines for breaking down rice straw for paper-making? Who sells steam heaters, in which the heat may be readily varied to suit the wants of the household? Who sells electric candles, as described on p. 339, vol. 36? Who sells decorative tiles? Who sells hydraulic lime?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

May 15, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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Wagon end board, T. Stevens 190,791
Washing machine, Baldwin & Parkhurst 190,804
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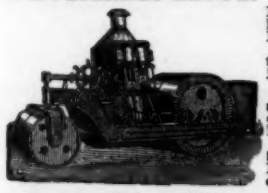

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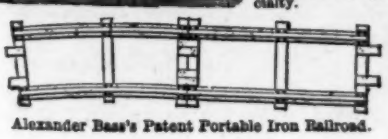

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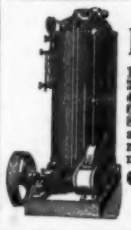

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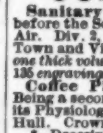

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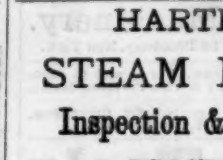

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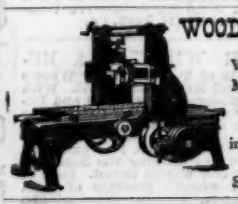

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